

October 10, 1960

# Aviation Week and Space Technology

75 Cents

A McGraw-Hill Publication

Aircraft Tested  
For Missile Site  
Support Work

USAF Launches First Blue Scout Rocket

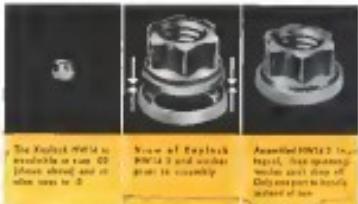




## Kaylock® 'captive washer' nut gains wide acceptance!

Since its introduction early in 1960, this new Kaylock® lightweight, all-metal self-locking nut with integral free-swinging metal washer has been specified by leading aerospace manufacturers for an increasing number of applications. Separate washers that used to drop off, roll away, and slide onto hardware at places have been eliminated. The danger of short circuits, due to these forgotten washers, also has been eliminated by the new Kaylock HW14 anti-vibration construction.

**Saves Assembly Time:** Kaylock HW14's cut extra motion required to put washer on bolt. Washer can't drop off during application or removal. Does fast tool locking for wayward washers—ta-ta! **Safer, too:** Kaylock HW14 "captive washer" nuts employ the same, sure elliptical locking principle to prevent vibration hazards. The Kaylock HW14 is a development of Kaymar Mfg. Co., Inc., world's oldest and largest manufacturer of lightweight, all-metal self-locking nuts. For complete details, call your nearest Kaylock representative.



### Kaylock. just to lightweight locking.

KAYMAR MFG. CO., INC. KAYLOCK DIVISION  
800 2nd Street, Atlanta, Georgia 30303. Branch offices and  
manufacturing representatives in New York, Newark, N.J.,  
Atlanta, Ga.; Boston, Wash., Montreal, Park London, The Hague.



The Kaylock HW14 is  
available in sizes CD  
(hex head) and C  
(allen head).

Nut and  
lock  
washer  
prior to assembly.

Assembled HW14. Just  
tighten, then separate  
nut and washer.  
Only one part to loosely  
assemble or disassemble.

CASSEGRAIN ANTENNAS: another prime capability of Goodyear Aircraft



1 48-inch transmitting & receiving antennas for U.S. Army fixed-wing

## ON REFLECTION, THEY AGREED ON GACI

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**GOOD**  **YEAR AIRCRAFT**

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The Polaris will locate and destroy its target some 1200 miles away with the help of Raytheon Weld-Pak circuit modules. These Weld-Pak units, based on an M.I.T. Instrumentation Laboratory packaging concept, are vital elements of the Polaris guidance system. Polaris is one of 22 U.S. Missiles that rely on Raytheon components and equipment.

RAYTHEON COMPANY

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AVIATION CALENDAR

- Oct 17-18—Iron Mining, Institute of the Association of Mining and Mineral Process Engineers, Queen Elizabeth Hotel, Montreal, Canada

Oct 19-21—National Safety Congress, 49th National Safety Congress, Conrad Hilton Hotel, Chicago, Ill.

Oct 21-22—Young Engineers Southeastern Annual Meeting, Atlanta, Ga., The Plaza Hotel, Atlanta-Buckhead, Ga.

Oct 19-21—Electronics in Space, Norwegian Institute of Rocket Engineers, Dæliholmen Hotel, Oslo, Norway.

Oct 18-20—Industrial Marketing Society, Hotel Astoria, New York City.

Oct 20-21—National Symposium on High Velocity Turbomachinery, Institute of the Aerospace Sciences, Sheraton-Sheraton Hotel, Seattle, Wash.

Oct 23-25—Annual Air Force Space Club Convention, Triplex AFM, Okla.

Oct 24-26—Mid-Year Conference, Airport Operators Council, San Francisco, Calif.

Oct 24-26—Meteorological and Biological Aspects of the Emissions of Space Vehicles, University of Wyoming, Laramie, Wyo.

Oct 25-26—Annual Meeting, American Society of Aviation Medicine, Arranged in South Bend, Indiana Institute.

Oct 24-26—Microelectronics and Solid Circuits, on the campus of the Massachusetts Institute of Technology, 14 Mass Ave., Cambridge, Mass.

Oct 25-27—11th National Conference on Standard Shearless Attenuation, Hotel N.Y.C., 27-28—19th Annual Electron Device Research Conference, Volmer Auditorium, D. C.

Oct 27-29—1960 Industry Technical Meeting, Hotel Electra, San Fran. Park, San Fran., Los Angeles Calif.

[Continued on page 6]

ANALYSIS WITH AND WITHOUT BACKUP

October 18, 1960  
Vol. 22, No. 15

**REVIEW** *The International Art Press* of  
London, published quarterly, £1.50 per  
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ANSWER SHEET: Berlin 10-1945

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# NOTHING IS TOO FAR OUT.... FOR GRUMMAN TO BE IN

This is a vapor screen photograph of hypersonic Mach 8 flow about a delta wing with underwing cone, taken at Arnold Engineering Development Center, located in Photo was made during Grumman research experiments, partially supported by Air Force Wright Air Development Division Flight Control Laboratory.

Shock pattern is discernible along the shock layer on wing (light area), boundary layer on wing (dark region), and shock layer on body (dark region). Bright white line on underside of wing and body is reflection of light source.

This photo characterizes the work Grumman is doing in hypersonic aerodynamics. Other efforts at Grumman include continuing design and development work on orbiting observatories, interplanetary communication systems, re-entry vehicles and reconnaissance satellites, to name a few.

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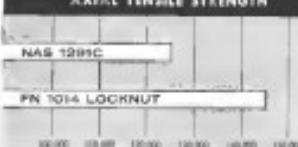


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#### KNOW YOUR ALLOY STEELS . . .

This is just 2 of a series of informative bulletins on  
the properties of alloy steels. These bulletins will be sent  
free, if requested. We believe it will be of interest to many  
in the field involving any type of heat treatment who may  
find it useful to review fundamentals from time to time.

## Thermal Stress-Relieving of Alloy Steels

In the production of alloy steel bars and parts made of alloy steel, stresses are sometimes set up, and these stresses must be relieved before optimum results can be expected. Two general types of stress-relieving are practiced—thermal and mechanical. In this discussion we shall consider only the former.

There are several important reasons for thermal stress-relieving. Among these are the following:

(1) The first and most fundamental purpose is to relieve residual stresses that might prove harmful in actual service. In the production of quenched and tempered alloy steel bars, via heat-straightening or necessary. This induces residual stresses varying in degree. There are usually stress-relieved after the straightening operation. When the bars are subjected to heat processing that generates distortion, subsequent stress-relieving must be necessary.

(2) A second major purpose of thermal stress-relieving is to improve the dimensional stability of parts requiring close tolerances. For example, rough-machining, residual stresses are introduced, and these should be relieved if dimensional stability is to be assured during the heat-treating.

(3) Thermal stress-relieving is also recommended as a means of restoring mechanical properties (especially ductility) after certain types of cold-working. Moreover, it is required in the "safe-welding" grades of alloy steels after a welding operation has been completed.

Alloy bars are commonly stress-relieved in furnaces. Temperatures under the transformation range are employed, and they are usually in

the area from 800 deg to 1200 deg F. The amount of time required in the furnace will vary, being influenced by grade of steel, magnitude of residual stresses caused by prior processing, and mass effect of steel being heated. After the bars have been removed from the furnace, they are allowed to cool in still air to room temperature.

In the case of quenched and tempered alloy bars, the stress-relieving temperature should be about 100 deg F less than the tempering temperature. Should the stress-relieving temperature exceed the tempering temperature, the mechanical properties will be altered.

Items other than bars (parts, for example) can be wholly or selectively stress-relieved. If the furnace method is used, the entire piece is of course subjected to the heat; selective relieving is impossible. However, if a liquid salt bath or induction heating is used, the piece can be given overall relief or selective relief, whichever is desired.

Detailed information about stress-relieving is available through Bethlehem's technical staff. And remember that we can furnish the entire range of AISI standard alloy steels, as well as all carbon grades.

*Our series of alloy steel information sheets is now available at a complete booklet, "Quick Facts about Alloy Steels." If you would like a free copy, please address your request to Publications Department, Bethlehem Steel Company, Bethlehem, Pa.*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.  
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**BETHLEHEM STEEL**



NOVEMBER				
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
1	2	3	4	
5	6	7	8	9
10	11	12	13	14
15	16	17	18	19
20	21	22	23	24
25	26	27	28	29
30				

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## EDITORIAL

### Where Do They Stand?

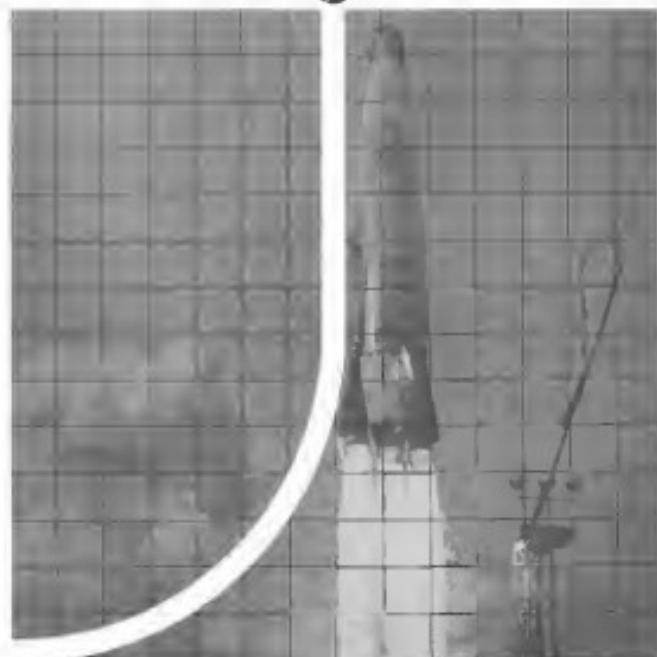
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With only 30 days remaining until the presidential election, neither candidate for that high office has seen fit to expand his proposed policy on one of the most important issues governing the future of that country. This issue in its broadest sense is national defense, and includes not only our formal military establishment but also the economic and foreign policies that reinforce with the military to weave the intricate fabric of national power and international influence. It certainly must include the critical uses of atomic explosives and use for scientific, commercial and military purposes.

It is now that the defense issue has dropped even slightly from the campaign onlooker importance of both presidential and vice presidential candidates. In the heat of the negotiating contentious last summer both parties placed strong emphasis on the delicate state of their platforms. Vice President Nixon deemed it of sufficient importance to ask the departure of President Eisenhower to accept the stronger defense views of New York's Gov. Nelson Rockefeller. Similarly both parties picked vice presidential candidates who had our standing regard as advocates of stronger national defense.

As the campaign has progressed it has no doubt been encouraging for American citizens to learn that Vice President Nixon is strenuously opposed to "shedding the case" and that Sen. Kennedy is against economic depressions. But we suspect that there are other more concerned about what these two gentlemen and their cohorts plan to do about the staggering influence of the United States in the international aspect and the failure to pursue a strong and vigorous national defense policy that fully exploits the technological revolutions of the past decade. No amount of campaign oratory can gloss over the fact of the staggering prestige of the basic reserves therefore. Even a meager reader or television viewer can see the results of this almost daily in the pounding of Nikita Khrushchev's fat fala on the United Nations' desks and the hideously outsize of the big lie technique that the Soviet chieftain has been spouting from the UN assembly board.

At the same time, the validity of defense cutbacks during the past year has been confirmed by the quiet actions of the Eisenhower Administration during the past month. As quickly as possible in the golden bowl of Washington, the Administration has been sifting the additional defense funds voted by Congress into less developmental programs. These additional funds were bitterly demanded last summer by President Eisenhower in unnecessary and were promptly taken by the Budget Bureau and Defense Department. The President further put himself on record against any increases in the defense program in his now famous "Job's book" blast at his defense critics at the Republican convention.

in Chicago. As late as last August the Administration stood firm on freezing about \$661 million of the added funds voted by Congress (AW Aug. 15, p. 25).

Now in the waning weeks of September and the early days of October this same Administration has been throwing out these round numbers and quietly reducing them into the very programs that the citizen has been hearing about since last January are requiring more funding and higher priority. The roll call of the projects gaining these additional funds (AW Aug. 8, p. 21, Sept. 26, p. 25; Oct. 10, p. 30) is the same as the key priorities announced as in the defense crises for at least nine months—Polaris, Minuteman, Strategic Arms, B-52, MATS coordination, modernized Army equipment, anti-submarine warfare, DynaStar, Skyrail and other key research areas. We certainly agree with Defense Secretary Thomas Gates' observation that the defense budget can no longer be operated within the strictures of an annual budget procedure and must be subject to constant review and change to meet technical and political shifts and opportunities. But we think he also would agree with our observation that it is far better to conduct these reviews in advance of and in anticipation of overall policy shifts rather than far too long after the grim facts have become all too evident to the rest of the world.

Again the defense critics of the Eisenhower Administration have been confirmed in almost every detail of their bill of indictment by the Administration's action in recent weeks. Patriotic souls should go to the military leaders who had the courage to voice these honest convictions before Congress last spring and to the congressional leaders who believed them and pressed seriously for stronger emphasis and higher priority for key technical developments in the defense spectrum. In view of that notable success, it is rather surprising to see one of its chief architects, Sen. Lyndon Johnson, the Democratic vice presidential candidate, resist the opportunity to emphasize the results of his work and the stunning proof of the validity of his thesis.

We suspect that Mammie Nixon and Lodge may be quietly waiting until this fiscal bookkeeping is completed in the Defense Department and then announce it with considerable fanfare in convincing proof that their party is not unkindly of defense requirements.

In any case, we believe the American voter will approach the polls with more positive convictions after both candidates express themselves clearly on the vital defense issue. It will indeed be a difficult choice of national leadership in the international crisis ahead, upon us if either are fit to develop a vigorous policy and takes a firm stand in this area.

—Robert Hora

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## WHO'S WHERE

### In the Front Office

Charles G. Guldberg, president and general manager, Eastern Airlines Inc., New York, Washington D.C., succeeded Martin T. Doyle, resigned. Mr. Doyle continues as chairman.

United Aircraft Corp., East Hartford, Conn., has appointed Robert A. Agnew as a member of the corporation's executive and policy committee. Mr. Agnew will be general manager of the Nedco Division of UAC.

H. O. Baker, vice president and director, North American Division of North American Aviation Inc., Los Angeles.

Richard King, vice president, Electronic Components, Inc., New York. Mr. King is president of Electronic Industries Co., Inc.

Howard W. Horner, vice president finance and controller, Boeing Airplane Co., Seattle.

John P. Day, vice president-engineering, Cooper Aerospace, Palo Alto, Calif.

G. A. Cleopatra, vice president-production, Lockheed Aircraft International, Los Angeles, Calif. Also: G. A. Holland, vice president operations; and F. A. Kastner, treasurer.

Mark J. Jones, executive vice president and director of operations, The Electrolux Corp., Beverly Hills, Calif.

Kenneth A. Neid, K. D. Deitsch (JUN), et al., vice president, Hamilton Corp., Little Rock, Ark.

Allen F. Barnes, senior vice president integrated, Aerospace Corp., 30 Lexington, Calif. Also: Jack H. Lewis, vice president systems research and planning; William W. Deale, Jr., vice president-administration; Stephen E. Holden, executive engineer; Ed Ward J. Koenig, vice president and general manager Engineering; Dr. Charles M. Morris, vice president and general manager Electronics Division.

Frank C. Shultz, Jr., vice president marketing, American Conservation, Inc., Culver City, Calif., a division of Astro-Science Corp.

Robert E. Bowditch, vice president sales, Transocean Electronics Corp., St. Paul, Calif.

Robert W. Belden, vice president in charge of reliability, Semiconductors, Inc., 1000 General Instrument Corp., New York. James R. Brown, vice president-administration, General Control System Co., Roseland, Calif.

Emory T. Nourse, Jr., vice president and general counsel, Northwest Coast Air, Inc.

Joseph P. Giordan, vice president, Calif. and High West Divisions, Electromar, Telco Corp., Philadelphia, Pa.

Lide M. Nichols, vice president-administrative, Western Design, division of U.S. Industries, Inc., Denver, Colo.

Fred W. Wolcott, assistant director of personnel, Office of the Director of Defense Research and Engineering, Defense Department of Defense, Washington, D.C.

G. Ward Hobbs, director of the Federal Aviation Agency's Bureau of National Caps of Airport.

(Continued on page 113)

## INDUSTRY OBSERVER

►Vertol Division of Boeing has won an Army Transportation Research Command competition for a drag study and preliminary design of a ground effect aircraft and landing vehicle (ITDTS). Ground research for last year's model tested earlier at Princeton University's Technical Research Center (AW Dec. 7, 1959, p. 157). Other bidders included Convair, Grumman and North American.

►General Electric and Avco are studying plasma engines for use with a 30-watt nuclear electric power system under USAF contract.

►Turbital Air Command will close holding in December for the acquisition of STOL fighter-bomber competition and expects to commence the second test January. TAC is assessing two engines for vehicles and a two-man crew because of complaints of managing electronic equipment. Dragster probably will incorporate variable-pitch wings to reduce short takeoff and landing characteristics and reduce buffeting at supersonic speeds at sea level.

►Winner of an Air Force Ballistic Missile Division study contract for a permanent satellite base and logistics support under Study Requirement 17532 is expected to be chosen before Nov. 1. This follows a long observation study under SR 185 (AW Apr. 27, 1959, p. 20), on which no specific action has been taken.

►USAF has shown continuing interest in NASA's Sauron space robot, and planned operational flight schedules of four per year could easily grow to 20 to 40 per year if both USAF and NASA order it.

►Navy is anxious to see fasteners like the McDonnell F-4H interstitial to hold wave of high development costs, although the company is not predicting current sales. Latest Navy effort was recent demonstration of the result for the lead of the Royal Australian Air Force at Georges Head. McDonnell's F-104 Starfighter also was demonstrated for RAAF.

►North American Aviation is formulating a concept for a super B-57 dog-to-ground missile in case Douglas Skyhook air-launched ballistic missile doesn't meet projected USAF schedule. Skyhook managers insist the project is proceeding according to the planned timetable.

►Bellco 30 and 30 companies are expected to submit bids today to NASA's Marshall Space Flight Center for a single scientific payload instrument to test all components, subsystems and completed assemblies of the Saturn vehicle. NASA wants design to use existing hardware. Six-month program will begin with a two-month study program to define requirements and will include design, fabrication and checkout phases, with funding at the attributable costbasis of each phase. Bidder will include Bellco, ITT, Northrop, RCA and Stroustrup-Carbo.

►Grumman HS-1100 helicopter (AW Aug. 31, 1959, p. 128), powered by two 135-hp Lycoming O-360 engines, has received the previous type certificate from Federal Aviation Agency after seven weeks of test flying.

►Navy's Atlantic Underwater Test and Evaluation Center will be entirely instrumental for underwater warfare research, advanced torpedo testing, sonar studies and other underwater warfare problems. Management of AUTEC, with its base sites on islands in the Grand Bahama, will be Navy's with technical assistance from industry.

►Douglas Aircraft Co. has a USAF contract to study materials and practices in composite skin handling and use of liquid hydrogen. Work is being done at Douglas' Sacramento, Calif., facility and probably is related to Douglas' work on the S IV stage of the NASA's Saturn vehicle.

►Proposed high altitude and ground communications schemes for USAF's Dyna-Soar boost glider are being submitted this month to Boeing, which is prime contractor for the glider portion of the system.



AN ACHIEVEMENT IN DEFENSE ELECTRONICS

## WHAT'S BEHIND A BMEWS RADAR?

Years of experience—for as early as 1954, General Electric had conceived and developed radar equipment capable of detecting ballistic missiles at 1,000 miles. This was the forerunner of the AN/FPS-50 surveillance radar being provided by General Electric under subcontract to RCA for the Air Force Ballistic Missile Early Warning System (BMEWS).

The AN/FPS-50 radar equipment, with a range in excess of 2,000 miles, is a singular example of achievement in defense electronics. It is another milestone in General Electric's sustained engineering effort to develop and produce equipment to meet the unprecedented detection problems posed by ICBM's.

110-01

*Progress & Our Most Superior Product*  
**GENERAL ELECTRIC**

DEFENSE ELECTRONICS DIVISION  
HEAVY MILITARY ELECTRONICS DEPARTMENT  
SYRACUSE, NEW YORK

## Washington Roundup

### Defense Budget Outlook

Enclosed Administration is sticking close to the current defense spending level of about \$40.2 billion in preparing the fiscal 1962 budget. New money requests generally run about the same as expenditures. So the military budget the White House will add to Congress just before the President's forces will be practically the same as the one it received. The only significant change would be the addition Congress made.

Navy forces were told to submit three budget proposals in their initial "budget envelopes." One could hold the line at the current spending level, the second would be 5% higher, and the third would be 5% lower. The services also have been asked for a prioritized list of proposed add-ons to the budgets they submit.

**Air Force Arms Service Committee** staff report little Pentagon cooperation in drafting legislation on aerospace aircraft and missile procurement. Paul E. Hader, in the first in a series of Defense Department bills to ask Congress for prior review authority as well as appropriations. This year the armed services can initiate a review of programs along with appropriations committees.

Defense Department opposed this new approach, which was initiated by Congress last year. It means two rounds of budget hearings as Capitol Hill. And a specific authorization law will reduce Pentagon flexibility in shifting funds from one program to another.

Key questions to be answered in this new process: Should programs be authorized in terms of numbers, categories or dollars? Will the services need authorization to buy substantial quantities of aircraft and other major development, test and evaluation programs? How can Congress prevent Defense from bypassing congressional checks after the authorization law is passed without giving the department a free check?

There is some surprise in Congress that the Defense Department is switching programs from the procurement budget to research development, test and evaluation to hope of easing the new requirement for authorizations.

### Nuclear Tests Wanted

**America Energy Commission** is eager to get back to nuclear testing in view of decomposing results from test-ban negotiations. Returning last week from an international Atomic Agency meeting in Vienna, ATC Chairman John A. McCloskey warned of the dangers of allowing negotiations to dominate weapons testing for too long. He agreed with Sen. Hubert Humphrey's approach of setting a deadline. See Humphrey suggested June 1961.

McCloskey sees no reason why the U.S. shouldn't proceed with a series of small underground explosive, even wholly atmospheric, tests. He said such a program would "improve the science of seismology and those low-damaging and identification systems can be improved." McCloskey pointed out that there is no way of knowing whether the Soviets are testing underground right now. ATC is ready to launch an underground test effort in a few weeks' notice.

Congress sees the U.S. estate over testing in the segment of ATC and the Soviets in actually disseminate breakthroughs in small nuclear weapon yields. Substantial gains have been made, making a study of the nuclear weapon small enough to fit in a briefcase. But countries with large weapons under ATC restrictions may use the test weapon off world, but this, too, never seems been tested.

**Trans World Airlines** remains in a state of impasse following an indefinite series of board of directors' meetings. The airline continues to operate without a president and planes are still flying. No president will be named until the financial picture clears. Fred M. Gwin is still the leading candidate. Also in the floundering program comes to be David Hughes' reluctance to cancel the costliest division over TWA in return for their names. Board is expected to immediately recall.

**British government** continues to run against the decision to swap the Blue Streak ballistic missile and buy the Skylon from the U.S. Many elements of the press and Parliament still believe it was a mistake to trade on actual hardware program for what they consider to be still a paper design.

**Efforts in the Air Force** and Douglas Aircraft, Skylon's developer, to overturn this finding have included a visit to the Douglas plant by a group of British aviation writers. So far their efforts have accomplished little. Adverse reaction to the project has gained so much currency that the problem is getting the personal attention of AFMDC commander Lt. Gen. Arnold A. Schlesinger.

### NASA's Plans Change

NASA's program for commanded circumlunar flight with return to earth will be delayed beyond the original 1964 target so it can become part of the new Project Apollo. Only other official change so far in the 10-year program presented to Congress last January is an acceleration last spring in the Saturn booster program. Big artificial change in the program is the slipping Project Mercury schedule, with the second Redstone flight now set for the autumn of 1960.

—Washington Staff

# Saturn, F-1 and Rover Studied for Nova

**NASA evaluating alternatives for next generation vehicle; to set firm concept after systems are tested.**

By Edward H. Kolak

Washington—National Aeronautics and Space Administration is intensifying studies to determine whether Nova, the next generation space vehicle, will be based on Saturn, clustered F-1 engines or a nuclear-powered first stage.

Nova is expected to boost national aerospace to lunar landings and to interplanetary flights. Although final decisions on the Nova configuration is not expected for at least two years, NASA hopes to establish a firm concept in quickly in alternative systems can be evaluated.

In House J. Morris, director of NASA's Program Planning and Budget office, told AVIATION WEEK these developments will contribute to the Nova decision:

- Performance tests of the single-chamber 1.5-million-lb-thrust F-1 engine.
- Performance of the Project Rover reactor in flight test system.
- Evaluation of Saturn capability to rendezvous at low Earth orbit space station while carrying a vehicle which could be assembled in space stations. One subsystem would require multiple launches of the advanced Saturn C-2 vehicle.

Language favored explosive propulsion will also benefit the architecture, reliability, research program which NASA will undertake over the next decade, using continuous aerospace lunar programs for a much earlier flight end of this year, and a Ranger mission next year. Urbanian of Surveyor and Prospector cost of soft landing testings are scheduled after 1965 (AVW, Sept. 1, p. 26).

Using explosive propulsion is also being considered by other agencies in Venus and Mars in the near future. Program calls for a Voyager payload in orbit and return these planets in five years and is aimed at studying their solar and planetary

process cells for a small number of the largest vehicles.

The Marshall scientist gave a "preliminary" rate of thrust for determining the optimum vehicle size, which would be equal to the overall payload. For example, if Nova were to take the rendezvous approach and the usual instant of ignition had to be delayed to a 96 sec (197 sec total) what was 1 million lb. Saturn would be the most desirable rocket size.

One of the most desirable vehicle configurations will be selected by March 1968, and

in strong of his conclusion, Kelle

phorus, boronites, and development of instrumentation for eventual nuclear flights.

Other factors important in the Nova design are one year evaluation program could cost over \$1 billion an early, utilizing it one of the most expensive programs ever undertaken by the U.S. Government of large solid boosters (AVW Sept. 19, p. 26), and developing a liquid and augmented thermal protection system.

## Evaluation Requirements

Dr. Stewart said a good P-1 evaluation can be made from ground tests, but simulation of a nuclear-powered first stage without flying it is questionable.

Lockheed Aircraft Corp. and Martin Co. are conducting theoretical studies for NASA of the overall requirements for a nuclear flight test program, one phase of which is examining the nuclear booster at a ground-launch test stage. In conjunction with the Agency for Space Commerce, NASA is looking into the overall feasibility of launching the nuclear-powered energy source in the potential to deliver seven to 10 more the planned of thermal systems. He sought a high energy variant is aimed at collecting nuclear heatlosses. Low energy research is being done in the Surveyor program which is expected to produce medium power and generate plutonium units.

Marshall Space Flight Center recently began an arm's-length design study of the J-1, including tradeoffs of the single-chamber concept and its comparison with the liquid-fueled Saturn.

Marshall study is expected to take half year of a second study by H. H. Kelle of the center's Future Projects Office on the options use of liquid oxygen vehicles.

Kelle concluded that on the large booster classes (one, three and 10 mil. lbs. to 10 mil. weight) the same conventional approach would be beneficial of a large number of the smaller vehicles while the best approach ap-



Two-Stage Pershing

Aviation Week Publishing Company photo  
A two-stage Pershing rocket stands ready for launch during tests at Cape Canaveral, Fla. (AVW Oct. 3, p. 35)

## Anti-Missile Studies

Washington—Army Rocket and Guided Missile Agency is expected to award six contracts this week for the development of anti-missile systems based on the defense and space research findings made in the Pershing type.

Lockheed contractors for \$214,000 contracts are believed to be Convair, General Electric, Rockwell, Sperry, Martin and Systems Contractors will be chosen from among 191 firms ARMDA asked for proposals, and they will make complete systems studies. Contractual costs for the anti-missile program will be given Army strength for supporting missile subsystems and components in part of Army's program to develop a missile capable.

ARMDA will conduct plans for the dual-launch system, taking the first division of 10 missiles from developmental contracts will be awarded to several companies. ARMDA will set initial production

and then operational and cost assumptions for 1966.

• One million pounds of cargo and equipment will support two 100-man ground stations and a 90-mile space station for a year, each man having a two-month duty tour.

• Four million pounds of cargo and equipment will support a 10-man lunar observatory for a year with seven of the first crew members as scientists.

• Reliability—60 percent established in 1968 by 21 successful flights of the Saturn, nine flights of the enhanced Saturn and one flight of a 10-million-lb. vehicle, which is the approximate weight of a heavy vehicle using a clustered F-1 booster.

• Vehicles will be operated over a five lifetime.

• Configuration included development of boosters to assist in cost of production development, transportation, launch, major, flight and ground support and propellants for each vehicle.

Kelle detailed the proposed program for the first year. To be carried over a five year period with the condition that the nuclear power plant's weight is the main constraint. A nuclear power plant program would cost 56,494 lb. less. 3 milles. to program would cost 57,974,000, and 10 million-lb. booster program would cost 57,965 lb. less. Kelle said.

He added that if the spending period were extended to 10 years larger vehicles become more economical because the high development cost can be distributed over more flight vehicles. If transportation vehicles cost 2 mil. lbs./lb per year, he said, larger vehicles become more attractive because of a considerable reduction in the number

of the launch complexes required.

For a 3 million-lb launch transportation scheme, Saturn boosters would require nine pads (14.6 days of pad time to prepare for each launch), 3 million-lb. boosters would require eight pads (10.7 days per pad) and 10 million-lb. boosters require four pads (11.4 days per launch).

Advanced Soviet configuration, with a maximum of 3.5 million-lb boosters is considered at the least an intermediate stage in the program to achieve early long-range exploration by means of orbital vehicles.

Dr. Werner von Braun, Marshall director, said a launch complex into a flight polar orbit from earth is less complex and may be cheaper but would cause high rates of dependence in a flight of 12 million lbs.

Nova will be the fifth generation U.S. space vehicle following the three-generation Saturn. First generation boosters C-1 and Vanguards have been phased out of use. New generation growth in the second generation are: June 1968, Theta Alpha and Able Star; Alpha Able Theta Alpha X and Delta. Third generation will include Theta, Theta-Angle X, Beta, Beta-Angle Y and Gamma.

## Apollo Capsule May Have Glide Capability

Santa Monica, Calif.—Apollo there two capsule for lunar return and other space missions will probably have some aerodynamic glide capability to ease the module landing problem. Dr. Werner von Braun of NASA Marshall Space Flight Center told the Douglas Aircraft Co. management staff here.

Apollo is one of the more advanced planned vehicles for the Surveyor space booster system and was planned as a blunt-based, conicalized design built around the Surveyor capsule which

## Apollo Bids

Washington—Three companies will be selected in mid-November from approximately 25 proposals in National Aeronautics and Space Administration's Apollo program for construction of 12,000-lb. modules for the 1967-1968 flights. The edge which this selection must have in each of the three firms selected will affect building for the Apollo prime contractor will be opened to cost bid for all of industry. In complete, purpose of the procedure is to encourage industry to compete to create competitive bidding and to be competitive partners.

Capitol is encouraged as a subcontractor. Three firms for their work function in space. Launch is tentatively targeted for 1968.

## Soviet Record Claim

Moscow—Soviet Russia has claimed a new record soviet distance record for balloons. Pelele Balloons reportedly flew a balloons 381 MiL MiL from Moscow to Kazakhstan, a distance of 1,200 Km. (747 mi.), in 7 hr 40 min. Previous record, set by Belobelski in 1958, was 791.918 km.

but no aerodynamic glide capability.

Van Braun told the Douglas management club that after Saturn the aircraft industry must put more emphasis on a more economical housing. And he hoped to see the rest of cost of development reduced to \$1 billion by 1970. He believes that Soviet S-1 C-1 would be the last basic aerospace effort to conquer space, and called it a truth effort to search the Russian ability to build heavy payloads. He and grim will be weighted against our more carefully in the future.

Von Braun said re-usable boosters are important cost-cutting device. NASA has been working on a recoverable system for the first stage of the Saturn booster, but has found the first few vehicles will be launched without it. He said the contractor for the system has stopped behind schedule and NASA cannot afford to pay for an extensive effort to catch up. The heart of the system is a 60-ft. drop tower which is a constant factor which accelerates the falling boosters to Mach 3. At that point a mind parabolic a deployed and gradually opened to continue the deceleration. The low margin nature of the single booster tanks makes rapid deceleration feasible and low axial solvent density at extreme altitudes limits aerodynamic heating at the high initial Mach numbers.

Van Braun said the staging area of Saturn C-1 "is fine" and the two upper stages are too light for the power available in the first stage. He said the duration is to go ahead with the early flight stage C-1 was used for. One of the important improvements in the development of the 17,920-lb-thrust Centaur hydrogen-helium engine by Pratt & Whitney and the lack of making use which can result in a 20,000-lb payload. It was originally planned to wait for the first stage C-1 with a more nearly optimum staging ratio.

Von Braun and NASA is giving attention to the possibility of launching Saturn and the projected Mars mission from offshore Test sites. No more than two Satans' month can be fired from land base because of time gap to the pad and other installations. He said the 25-ft tall Saturn service tower will be completely mobile at Cape Canaveral around the end of this month.

## Belgian F-104 Order

Bremerton, Wash.—It has agreed to order were financing of 25 Lockheed F-104 interceptors for the Belgian air force, leaving the total number of aircraft on order to the 180 originally planned in the Belgians, who will enter the cost of 75 (AVW Sept. 26 p. 34). Mutual agreement was reached in negotiations over terms held between the two countries before the announcement.

Kodell concluded that on the large booster classes (one, three and 10 mil. lbs. to 10 mil. weight) the same conventional approach would be beneficial of a large number of the smaller vehicles while the best approach ap-

# Major GE Defense Facilities Escape Impact of IUE Strike

**Washington—** Some General Electric defense plants escaped the impact of the International Union of Electrical Workers strike against the non-unionized test work center because they have no union or have signed contracts with other GE units.

The IUE did affect GE's Pittsfield Mass. plant where the Ordnance Dept. produces missile platforms for Polaris missiles and has caused rioting by Polaris subworkers. The union also struck at GE's Springfield plant where Heavy Military Electronics Dept. goes direct buy rather than do defense work.

At GE's large jet engine and rocket engine plant in Eastman, Ga., the United Auto Workers (UAW) and its national Apprentices of Mechanics (IAM) locals both voted no strike. The company says a three-year contract with an incentive of 10% increase and no other 4% per hour in 18 months.

The IAM also accepted the reorganization at GE's Light Military Electronics Dept. in Utica and Johnson City, N.Y. Mobile and Space Vehicle Dept. in Philadelphia has no union.

The UAW is a member of the AFL-CIO, so far failing to elect any grievance managers from its members' organizations. It says that less than 1,000 Polaris workers report to Soviet subcontractor Motor Sich, speaking at a special meeting of the Soviet Academy of Sciences. An indication of engineers' general favorable opinion, Soviet officials indicated that suitable shock absorbers now are available.

During the future of manned space flight life and space vehicles will have an insulated shield under the atmosphere and temperature favorable for humans and equipment can be artificially maintained. Pictures in the capsule will fluctuate between 700 and 900 nm of medium with partial oxygen pressure of about 160 mm, which corresponds to approximately 20-30% of normal air. Carbon dioxide concentration of the capsule should not exceed 1%.

Thus the problem of protection of a manned space vehicle. Studies conducted that the Soviet Union has long been interested carrying out a program of such actuality of analysis and equipment from space. Soviet and biological experiment on the second vehicle showed temperature increases in aldehydes-alcohols and their presence as well as a reduction of deactivation effects on the two dogs Belka and Strelka.

The administration's Liquid Solar and that while he is confident that the new space vehicle will make interplanetary voyages, "it should be emphasized, however, that in the context of double hypothesis of making space capsule around the moon and other planets it will be necessary space laboratories controlled by radio from the earth." Concerning flights to Venus and Mars, he pointed out, "to make these flights, new developments will have to be overcome. In particular it will be necessary to ensure still more accurate operation of navigation."

Moscow demands and violates an

the picket lines of major plants at Springfield, Pittsfield, Philadelphia (switchgear plant) and Lynn, Mass., as factory and white-collar workers sought entry, prompted GE to seek court injunctions to stop nearly 10,000.

George Meany, president of AFL-CIO, was in town with the presidents of several unions, last week, to evaluate a program for support of the IUE strike.

Although some observers see the reported lock-out workmen as an indication of a speech settlement, others speculate that in potential threat to GE's leadership will spark a long and painful violent strike.

## Soviets Report On Space Flight Studies

**Moscow—** Studies as far far to detect any possible damage to human nervous system from the prolonged space travel (AW Aug. 26, p. 25), according to Soviet astrophysicist Mihail Sich, speaking at a special meeting of the Soviet Academy of Sciences. As a professor of engineers' general favorable opinion, Soviet officials indicated that suitable shock absorbers now are available. During the future of manned space flight life and space vehicles will have an insulated shield under the atmosphere and temperature favorable for humans and equipment can be artificially maintained. Pictures in the capsule will fluctuate between 700 and 900 nm of medium with partial oxygen pressure of about 160 mm, which corresponds to approximately 20-30% of normal air. Carbon dioxide concentration of the capsule should not exceed 1%.

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# Army Courier Tests Space Communications

**Washington—** Army Signal Corps plans an extensive program to field develop active retransmitter satellite operational techniques during the expected early life of Courier IB, which was launched into orbit last week.

The 300-lb delayed repeater satellite was launched June 26 by the Air Force's first Able Star mobile booster with a Thor Able Star vehicle. It was inserted into an orbit with a 252-mi apogee and an orbital lower limit of 120 mi and runs at 200 deg. below the desired 120 mi and has still within acceptable limits. The 607-watt microwave signal will orbit the desired 100,000 nautical miles from Earth's period is 186.3 sec.

Courier IB's payload is identical to the 510-lb delayed package (AW Aug. 29, p. 27) of the Courier IA launch attempt which failed Aug. 18. It contains about 180 lb of science equipment including five transponder experiments, electronic TM and VHFR telecast transmission, infrared gamma-ray detector and command encoder.

Initial operational test was made on the second orbital pass when a voice message from President Eisenhower to Secretary of State Christian Herter was beamed from T-3 (Monmouth) to T-2 (Cape Canaveral) via the Command ground station at Schenectady, N.Y. It was then relayed to T-3 via Puerto Rico to Herter at the United Nations in New York.

After the French missile was shot down, a statement by Army Signal Corps' Major M. Blodgett, which was forwarded and stored on tape before launch, was broadcast from Courier. Although Courier is considered a

## South African Station

**Washington—** USAF tracking stations at Peoria, Ill., and South Africa are to receive Courier IB and its successor, but by Radio Monrovia, U.S. and its site in South Africa, Philip K. Green commented that the tracking station at Peoria is for research and will be in South Africa about six months to track Courier.

Courier prime contractor working under Signal Corps management are Philco Corp., which built the payload Radiation Inc. designer of the T-1 (Monmouth) and Puerto Rico antenna, and International Telephone and Telegraph Laboratories, contractor for ground receiving, transmitting and control equipment.

Courier launch by the Thor Able Star was the 106th time the Douglas Thor has been used as a booster. We have seen its career of 31 successes at 37 space launch attempts, and 42 successes in 45 military and Earth-to-orbit flights. To date, Thor Able Star configurations, 79.5 ft tall with total weight



## Strike Effect on Polaris

**Washington—** Effect of the defense union of Electrical Workers at General Electric's Ordnance Dept. in Pittsfield, Mass., is expected to delay deployment of my Polaris submarine scheduled to go into service this year. Navy officials said Atlantic Test Naval Detachment to conduct an immediate audit of all Polaris sub facilities. Heavy Aircraft and Missiles-Pittsfield reportedly set up a strike committee. GE's Ordnance Dept. for Polaris maintenance, which has been operating under a strike agreement, should have begun to make delivery. However, there is no union voice with GE's Ordnance Dept. for missile control systems installed in Polaris submarines.

# Defense Frees More Extra Funds, Leaving \$288 Million Still Frozen

Washington—Defense Department has allocated more of the extra money Congress provided to accelerate defense programs, continuing its planned use of funds by the Administration, and it didn't need them when new law appeared.

Defense also has allocated all but \$288.6 million of the extra money, a substantial decrease from the \$621 million left after the Pentagon's Aug. 4 financial plan it issued (AW Sept. 25, p. 28). Congress provided a \$40.5-billion budget after making substantial changes in the Administration's proposed \$59.655 billion budget.

Democratic critics in the Administration's defense policy say that accelerating military procurement is a waste of纳税人的 money. But the U.S. should increase its defense effort when the opposition was voted last spring. That also claim the Defense Department, actually, still authorizes about \$49.5 billion because \$59 billion has been reallocated from obsolescent programs (AW Sept. 26, p. 20) and is available along with the \$288 million as further accelerate the military effort.

Defense Secretary Thomas S. Gates Jr. explained that these three changes in the financial plan are based on technological and political grounds. He said there is no annual budget limit on defense spending, and that defense spending will have to be increased periodically as the field of technological warfare evolves, with the purpose of maintaining national political readiness.

Specific areas include:

- **Space**: Aeronautics, \$16.6 billion, which when combined with \$88 million released Aug. 9, makes a total of \$18.5 million to accelerate its capability. (AW Sept. 25, p. 25)

- **Polaris**: missile program total of \$207.6 million divided into \$70.6 million for development of the B-57 missile, A3 missile and the economy for production of the second version of the missile. In total, Polaris spending is then becoming \$66.6 billion after release.
- **Aegis**: equipment \$2.2 million for purchase of ready personnel, exercise sites and other field equipment.
- **Anti-submarine warfare**: \$35.3 million.

Large block of funds still remaining available for the B-57 Congress could at this \$18.6 million to accelerate the program over the \$75 million Minnesota plan for developing into a flight test prototype. Defense released \$102 million in August and another \$84.3 million in September, while Defense, and Ad-

ministration's Joint Chiefs of Staff, issued an memorandum made by Congress earlier this year "in November that all of it was used all the time." If it becomes the responsibility of the Department to propose a defense budget to Congress, it would be required to add \$1.1 billion to the amount appropriated for inter-service costs which may be entitled to the B-57.

Defense still has \$18 million appropriated for Polaris, but not yet applied to the program, as well as \$67.5 million for Army modernization and \$3 million for inter-service costs which will be reduced slightly in the 3% cut in procurement funds, non-warfare-related budget to Congress. Other Defense budget allocations will change this program.

- **MATS**: defense modernization \$85 million, which was released by Lockheed C-130s and when the Air Force decided to rework a group of aircraft, five of which will be shifted to MATS as strategic aircraft.
- **USAF**: has shifted \$10 million to its study of a turboprop aircraft with a range of 1,400 miles.
- **Sleek**: a transonic fighter, much like an advanced F/A-18, which has been altered, resulting a total of \$10 million.
- **Prone**: flight research. Added total \$7 million. In a total of \$14 million.
- **X-15**: research aircraft purchased by Aerospace \$7.6 million for a total of \$6.6 million.
- **Down-Bound glider**: Aerospace \$5 million and a total of \$7.5 million.

## Eight Firms Submit OGO Spacecraft Bids

Washington—Eight companies have submitted proposals for a standard geosynchronous spacecraft which National Aeronautics and Space Administration laws will be a flexible modular package designed to accommodate up to 1,000 lbs. of instruments and to offer for manufacturing, graphical software, (OGO).

Goldman Space Flight Center's evaluation proposals and reports are issued a contract before the end of this year (AW Sept. 3, p. 26). Schedule calls for delivery of the S-8 prototype about 35 months after contract award and delivery of the flight model in 36 months later.

Launch is scheduled in early 1985. The S-8 prototype is scheduled for launch in late 1982 with the flight model coming six months later and launch in mid-to-late 1983.

Contractors will specialize on three categories of instruments: 1) high-altitude (100 km) and 200 km) magnetometer programmed for three Axis-Axis (B-3) and as the last order (100 km, up to 200 km) and 3) S-8. Two gyro probe satellite. Experiment will measure and determine energetic particles and with the earth's magnetic field and plasma, magnetic field control dust and large molecules, particle density, density and temperature, solar风和 atmospheric effects.

Now, however, the heat of the race is beginning in full, and some of the money is starting to flow, first through the Bridget Islands. San Jose, Calif.

About half of the existing and pro-

posed Primo subcontracts will go into the budget plan for developing into a flight test prototype. Defense released \$102 million in August and another \$84.3 million in September, while Defense, and Ad-

ministration's Joint Chiefs of Staff, issued an memorandum made by Congress earlier this year "in November that all of it was used all the time." If it becomes the responsibility of the Department to propose a defense budget to Congress, it would be required to add \$1.1 billion to the amount appropriated for inter-service costs which may be entitled to the B-57.

Democratic presidential candidate John F. Kennedy also insisted that all non-warfare-related defense policies, saying in his campaign that "our defense budget has not been managed in a way that wastes or squanders our resources." Other Defense budget allocations will change this program.

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## Democrats Sharpen Defense Policy Attack

Washington—Democrats last week sharpened their attack on the Administration's defense policy, charging that the President was wedded into skipping up total defense programs by the Defense Congress and became a "prime dental candidate."

Senate Armed Services Committee chairman, Sen. Alan Cranston (D-Calif.) charged that the President's leadership in the defense field has been replaced by a "military leadership" that is less concerned with the welfare of the American people than with the welfare of the military. He also charged that the President has become "more concerned with the welfare of the military than with the welfare of the American people."

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# NASA May Try New Technique On Next Echo Inflatable Sphere

Washington—A inflated, inflatable sphere is under consideration as the next Echo balloon because the success of Echo I makes questionable the value of launching another non rigid, non-instrumented test satellite (AW Sept. 25, p. 27).

National Aeronautics and Space Administration now is weighing the merits of right to non rigid, inflatable structures as the next step to develop a reusable, reusable passive communications system.

A spokesman commented to have a much longer useful life than a standard satellite because it will return its shape longer and at greater strengths to boost area ratio will lessen the effects of solar and atmospheric drag.

If NASA chooses a rigid sphere, it will have to do so at the cost of time for development and testing, possibly reducing balloon flights like those made with the non-rigid spheres from Wallops Island, Va.

NASA had planned to break the third and last Echo development sphere this year in early winter, but probably will not as long as Echo I remains a global relay satellite. The agency has used a modified one-year lifetime for the Echo sphere, based on extensive orbital calculations.

## Ten Objectives Met

Echo I has succeeded in all three of its test objectives:

- Study the effects of the upper environment on very long surfaces.
- Measure reflectivity and the manner in which solar energy travel through space.
- Determine the feasibility of using spheres in worldwide communications relays.

Details of the atmosphere at 932 mi has been calculated to be approximately 1.1 x 10<sup>-10</sup> "gramals." Below Echo's flight, an ionosphere density measurement was made for the first time ever, and the number of electrons per cubic centimeter was determined.

G. T. Schlegel Co. of Northfield, Minn., which built the 100-ft Echo I and last month is exploring a variety of techniques for making a solar sailer space environment tight. The company also used its own product, 100-ft-long spheres.

Siemens Corp. studies likely include making use of basic photovoltaic cells, solar collectors or electrostatic charge, and by increasing the tensile strength of metal foil. Other methods under consideration (AW Sept. 19, p. 24) are the use of umbrella-like stiffening and reflective ribs.

The greatest of solar sailers,

according to 1/300 of an hour—it probing Echo's perigee downward into the earth's atmosphere at the rate of 3.5 mi per day and has changed in orbit from semi-circular to elliptical, according to an analysis by Dr. Robert J. Larson and Robert Bryant of Goddard Space Flight Center's Theoretical Division.

From the launching date of Aug. 12 to Sept. 11, the perigee was dependent 932 mi on 500 mi. Atmosphere drag decreases the period about a second a week.

The low total force of solar pressure and slight drag at such high altitude has to go to effect the movement of Echo's elliptical high and low perigee rate of 10 m/s per hr—an average of 1,000 miles greater than earlier predictions.

Because the orientation of the satellite's orbit to the sun changes with time, solar pressure will not return the orbit to a circle and the cycle will be repeated periodically. NASA predicts that the perigee will drop to a maximum of 700 mi in mid-December and rise to 500 mi by the middle of April.

If the satellite rotates spherical, it lifetime is expected to be one accompanied with an estimated 20 years if solar pressure were not a factor.

Dr. Peter Motes of the Goddard Technical Division, developed the theory to calculate tidal pressure. The and tides of a spherical satellite were based on related orbital characteristics according to Dr. Jameson of Dr. French Space Inc. of the theory and numerical tool of Goddard's modeling and simulation department.

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Orbital elements as of early last week were: apogee 1,166 mi; perigee 572.7 mi; period 181.1 min; inclination 47.24 deg; velocity at apogee 15,269 mph; velocity at perigee 16,383 mph.

## House Group Reports On Engineer Hiring

Washington—Government contractors are asked spend more money to recruit and hire engineers and scientists from foreign readily to commercial business the House Post Office and Civil Service Subcommittee on Manpower Utilization charged last week.

In a petition awaiting cost analysis, 102 companies with military contracts the recruiting costs of the 3% doing more than 75% of their business with the government amounted to \$1.023. For each one engineer or scientist hired compared with 373 for the other 36 firms, whose business is predominantly commercial.

Results of the study, conducted by the Defense Department and released in the form of a memorandum, showed that new kinds of engineers and scientists for the 102 firms increased in general the rate of separation of engineers and scientists.

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## Silencing Explorer

Washington—Explorer VII is expected to be silenced on Thursday, one year after its launching, by a balloon. The balloon set to operate on a mesh bed by Jameson. If the balloon fails, the Army Ballistic Missile Agency payload will be the last to be freed of automatically. Some noise and vibration will persist indefinitely, will be used to silence efforts in radio noise insulation did not succeed. Explorer VII has been tracking data on radiation, magnetometer, operation of its expandable solar cells and temperature.

The report said an earlier study in 1987 resulted in a conceivable program to controlling the parasite load of contractor experts, but the subcontractor felt it needed more timely report on the effectiveness of procedures especially since the term "nonradioactive" was used as allowing to dislodge radioactive residues.

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# Scout Will Launch Satellite Next

Washington—First attempt to put a satellite into orbit using an orbital propellant launching vehicle will be made in the next experimental flight of National Aeronautics and Space Administration's Scout rocket—a moderately successful stage of the four-stage vehicle has a weight of 750 lb., payload of 100 pounds at 7,500 mi.

Decision to try an orbital experiment this early in Scout's developmental testing program indicates that NASA has considerable confidence in a vehicle that has been plagued with many costs and delivered apparently more than it was programmed and intended.

The satellite which may be launched this year probably will carry a moderate density communications payload or an air density measurement payload depending on the orbital altitude.

Scout was first at 22 25 a.m. EDT on Oct. 4 from NASA's Wallops Flight Station at Wallops Island, Va., at an angle of 51° deg. from the vertical and an altitude of 107 deg.

Scout is managed by Air Force Special Weapons Center to evaluate radiation in connection with monitoring of nuclear explosion in space, at entered the earth's atmosphere 50 minutes later at a point over the South Atlantic 5,800 mi. from Wallops and went down.

NASA said preliminary analysis of telemetry data indicated that the flight was completely successful. This was the first successful firing by U.S. of a fully-managed and guided Interstage solid rocket and was the longest and farthest by the U.S. Scout at 72 hr. 15 min. and 56.606 sec.

The 125-lb. payload section carried performance monitoring instruments and the first and second stages carried some 50 lbs. of nuclear instrumentation.

Scout was reentered two years ago in an attempt to develop a low cost sounding rocket and satellite launcher from existing hardware. First launching was at one time planned for the fall of last year. That attempt to test the

## BTL Optical Maser

New York-Bell Telephone Laboratories last week demonstrated an optical Maser that produces an extremely narrow beam of coherent light whose intensity at a distance ten times higher than the sun. In demonstration, BTL scientists conducted pulsed-light communication over distance of 25 m., using synthetic ruby Maser. Device has effective power levels for space vehicle communications (AW Feb. 27, p. 48; July 19, p. 96).

Previously uniform test and third stages failed last April 15 when a heat shield covering the third stage stage did not cause a structural failure prior to the first stage ignition.

First attempt to fire the full vehicle last July 1 was aborted by ground command before ignition of the fourth stage because Scout appeared to deviate an unusually high rate of roll and to change its flight path. Later analysis of telemetry data showed that the vehicle did roll but that a sudden shift of the tracking radar was blamed for a false indication of a change in flight path.

Scout for the first orbital try with Scout could be a sustained impact payload—carrying 100 presented evidence about the size of laser beam and from three other types of energy estimates devices developed by NASA's Langley Research Center Central Conference on renewable solar power is to have the Earth communications satellite which would be used to measure absorption during Scout is expected to be able to put in orbit a 300-lb. ratio a 300-mm. orbit, used a 50-lb. payload to 5,400-mi. altitude, or provide nearly 2 hr. of non-gravity noise with 100-lb. payloads fired on ballistic trajectories.

Scout is managed from Langley Research Center by a group headed by James H. Hart. Lt. Colonel E. Holly of AFSCWC was project officer for the USAF payload, and NASA's Robert T. Daily directed the launch team.

## Labor Chiefs Invited To Pentagon Meeting

Washington—Top labor leaders were invited to meet with the Pentagon's top civilian official, Secretary of Defense Thomas S. Gates in a move to ease up on continuing jurisdictional strife in construction and installation sites at ICBM bases (AW Oct. 3, p. 25).

In addition to the top, designed to speed completion of Atlas launching sites, the Defense Department would in further rights responsibility for the entire base construction program by assigning a third project, the \$24 billion Atlas base at Ellsworth, N. Y., to the Army Corps of Engineers' new ballistic missile construction office headed by Brig. Gen. A. C. Welling.

## News Digest

Paul expressed for European participation of Southern Hawk surface-to-air guided missile (AW Aug. 1, p. 31) has been signed by five NATO nations

—Belgium, France, Italy, The Netherlands and West Germany. Payment will suffice \$5,840,000 for patent and technical knowledge right.

Two contracts totaling more than \$23 million have been awarded by Sikorsky Aircraft for 538 helicopters for use by the U.S. Marine Corps and the Navy.

Radiation Airlines will spend \$9 million to buy seven Douglas DC-10s and spare parts from General Aeronautics Division of General Dynamics.

Walter T. Bowes resigned last week as director of National Aeronautics and Space Administration's Office of Peleke Information to become director of public information for the Aerospace Corp.

McDonnell Aircraft Corp. was awarded a \$164,365,525 Navy production contract last week to provide for delivery of the second breaking F-14A all weather fighter last p. 52 through 1982. F-14A contract now is \$56,896,400, accounting for 167 of the planned 400 aircraft production run.

Pelorus satellite with a new lightweight second stage was fired 1,091 mi. down the Atlantic Missile Range last week. Data on ahead was carried on a test of the company's real-time tracking system.

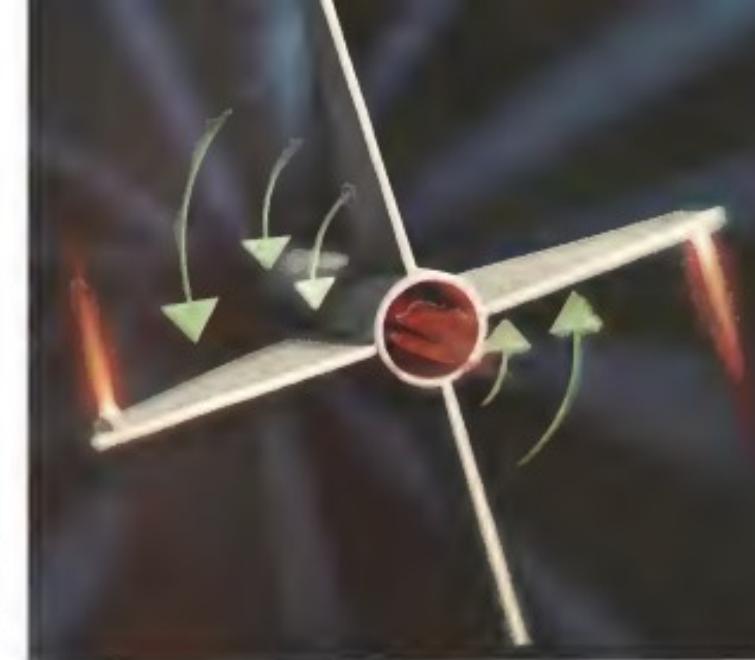
Seaboard & Western Airlines plans to shipback on \$4.25 million New York International Airport freight to Pan American World Airways as part of a financial enhancement program. If the move is approved by the Port of New York Authority, Seaboard & Western—which is attempting to raise \$4 million from the sale of new securities—would close Hunter R-1 terminal with Northeast Airlines.

Newlydeveloped Marlin Helicopters are to ground crews is being added to USAF's Republic F-105 fighter bomber (AW Oct. 3, p. 25).

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North Texas ICBM base will be built at Griffiss Air Base, Roswell, N. Y., at a cost of \$90 million. It will include two Titan stupendous, handling 15 missiles per site, spaced, dispersed in case.

Eastern Air Lines last week ordered five new Boeing 720 turboprop cargo freighter transports, for a total of 15 (AW Aug. 8, p. 43). Total cost is about \$66 million.



Reaction control at work in space—hypothetical.

## STEERING GEAR FOR ASTRONAUTS

Conventional aircraft control surfaces will not grade space ships and capsules. Rollers, solenoids and elevators need no constraints and hence provide no resistance to their movements where there is no atmospheric drag or air resistance. Some of the jets are finitely while others can be operated in combination to provide the astronauts positive and flexible control.

The simplest answer is a dependable steering mechanism for astronauts is a system of jet rotation control developed and produced by Bell Aerosystems Company. First used on Bell's own supersonic X-15 several years ago the system has been greatly improved and adopted for the X-15, the Mercury man-in-space project and other space vehicles.

Through magnetically lapped, low and high thrust (1 to

1500 pound) rocket engines Bell's reaction controls not only position and guide the ship by controlling the roll, pitch and yaw, but they also provide for orbit changes and orientation. Some of the jets are finitely while others can be operated in combination to provide the astronauts positive and flexible control.

This revolutionary steering gear for space, available using ion-propulsion at high energy input/output, is just one of many advanced projects which are currently engaging the diversified interests of Bell Aerosystems Company in the fields of military, avionics and space technology. Engineers and scientists seeking challenging, long-range career opportunities can find them at Bell.

**BELL AEROSYSTEMS COMPANY**

SUFFOLK, N. Y.

DIVISION OF BELL AEROSPACE CORPORATION  
Successor to the Defense Group of Bell Aircraft Corporation

Aluminum works in many ways for cooling and heating power



## Plumbing the Depths?

Alcoa goes to work immediately on defense projects

Aluminum is corrosion resistant in steam, high-purity water or salt water. That's why this water-conducible metal holds such promise in marine applications, as in atomic subs and reactors, for example. Alcoa even anticipated the day when water would be the cooling medium for reactors that generate temperatures ranging from 500° and higher. We now have several new aluminum alloys able to handle these higher heats. Ask yourself where you can use them. For more information, write Aluminum Company of America, 2026-K Alcoa Building, Pittsburgh 19, Pa.

**ALCOA ALUMINUM**  
ALUMINUM COMPANY OF AMERICA

## AIR TRANSPORT

### Fuel Injection Failures Grounded Il-18

Quesada reports engine problem halted operations, calls Aeroflot operating facilities substandard

Washington—Aeroflot's Il-18 jetpropulsion transport has been grounded because of engine fuel injection failures which have caused burned-out combustion chambers, according to E. R. Quesada, Federal Aviation Agency administrator.

Quesada who returned last week from Moscow after a three-week tour of the Russian airline's system, said the Soviets refused to admit that the Il-18 had been grounded but added that it was highly evident that the aircraft had been withdrawn from service to undergo a fleet retrofit program. He showed Aeroflot's operating facilities are below Western standards and added that the Russians admitted they were embarrassed about showing the group facilities at sonst points on the user license of substandard conditions.

The FAA chief described the Il-18 as the "best airplane" the Russians have in their civil transport inventory, and compared it with the Lockheed Electra. Soviets indicated that the Il-18 will be back in service soon (AVW Aug. 9, p. 42).

Quesada was unimpressed with the Avia-10 turboprop aircraft, and in comments made to the U.S. Senate foreign relations subcommittee during one stage of the tour, he noted that the aircraft has strict control forces higher than

the Il-18. Because there is apparently no hydraulic control system, it takes two pilots to work on the plane. He also noted that the Russians "won't have had static very good engineering" on the Il-18's propellers, which have a high thrust-to-weight ratio, but added "we understand that on the engine, because of its high fuel consumption."

He said that the Russians would not comment on the delay in introducing

the Il-18. Because there is apparently no hydraulic control system, it takes two pilots to work on the plane. He also noted that the Russians "won't have had static very good engineering" on the Il-18's propellers, which have a high thrust-to-weight ratio, but added "we understand that on the engine, because of its high fuel consumption."

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### Birds May Have Caused Electra Crash

Crash of an Eastern Air Lines Lockheed Electra last week near Boston Harbor took the lives of 81 lors en vol reported exaggeratedly blamed the birdstrike for a moment.

Federal Aviation Agency Administrator E. R. Quesada said he would not ground the Electra because there was an absence of evidence of aircraft damage in the accident, which was the fifth or less than two years of service to the plane. The FAA said all evidence indicated the Boston crash was caused by a collision with thousands of starlings which have been caught in the engine intakes, producing a "thunder" condition.

The Eastern aircraft was flying off Long Island, New York, from Boston's Logan International Airport on a flight to Philadelphia, Charlotte, Greenville and Atlanta. Wind and weather were normal, with a visibility of 15 mi. The plane reached a altitude of 20,000 ft., turned left and traveled about 2000 ft. from the end of Boston's 4th before crashing into a channel in the water.

The plane was carrying 87 passengers and a crew of five. Of the crew, only the two commanders survived. One reportedly suffered only minor injuries and the other a broken pelvis.

Sen. George H. Mahon, D-Tex., raised a missing evidence with Quesada by observing that the Electra had passed and that Quesada ought to know what Quesada implied that he was unaware of any existing background?" pointed to the matter.

Meanwhile Lockheed Aircraft Corp. is in full with ordered jet undelayed Electra heating fans incorporated as they go through the line. These modifications are designed to combat the structural fires which caused two of the Electra accidents (AVW Aug. 9, p. 10). Part of the planes with fans built in is expected to fly this month, and the first other Electras in route to the modified form is scheduled to arrive in mid-November.

the large Tu-174 turboprop or the high-fuselage Tu-154 medium-range transport are now service. Both planes were listed in scheduled service this year according to earlier Russian announcements. Originally the Tu-144 was expected for service in 1970, but the first flight of the Tu-144 in 1970, and the first flight of the Tu-154 in 1971.

Throughout prior to his departure from Moscow Quesada said that American officials told him in terms of using the Tu-144 if and when a route to New York developed. He said that Soviet officials shared enthusiasm over the use of the Tu-144 to transport tourists (AVW June 6, p. 17) but was rather noncommittal about the Tu-154 to meet IATA Aug. 22, p. 411 which they seemed to regard as no big deal for the purpose.

He said there may be some concern the passengers on the Tu-154s have limited air space available. However, he was told, but he felt that the plane was being designed for "speeds under Mach .7" and that it could be made for flight within five years.

The 12-day delegation visited Soviet stations and facilities at Moscow, Leningrad, Kiev, Tashkent and Stepanovsk. Other members of the group were Stuart G. Tappin, president of the Air Transport Assn.; White Lynch, assistant president, Pan American World Airways; Raymond Dunn, vice president, Trans World Airlines; Howard B. Read Corp.; Raymond M. May Jr., D. M. McLean, Arthur C. Gandy of the FIA; and State Department counselor Alexander de Bodeberg.

### Quesada's Observations

In Moscow, Quesada gave this country a lot of information during his visit.

\* Airports. Landing fields particularly runways are not in good condition throughout. They have rough, or some times too short for the large transport aircraft used by Aeroflot. For example, the length of the Tu-104 jet transport is which the delegates left Tashkent just from pavement with only a 50% of the surface left, instead of about one-half which would be standard in the U.S. There is no storage for engines, before or after, he said.

\* Pilots. "Pilots are quite good. It would be true that Aeroflot are very strong in our selection. I think that follows in the Tu-104 here had a lot of trouble



## Soviets Building Downtown Moscow Air Terminal

Moscow's new downtown air terminal, on which construction began recently, is designed to handle more than 50,000 passengers daily and up to 1,200 hourly during peak periods. Located in a three-story building, the new terminal, situated with other country's visiting envoys, restaurants, etc., will be more than 800 ft long. Two modern, 17-story buildings will be built near each end of the main structure but closer to the river. One of these will be a four-star hotel for international passengers. The other will house offices and service facilities. The concrete, glass and aluminum terminal will be connected by escalators with a new station on the Moscow metro. Helicopters and special express boats will take departing passengers directly to planes at the Russian capital's principal airports and bring incoming passengers back to the downtown terminal.

**Flight** That ability, for example, to hold a proper approach speed is highly developed." The FAA chief noted that the Tu-104's over-the-fence speed is some 190 mph, compared with some 125 mph for the Boeing 707.

**Navigational facilities** Soviet navigation aids are below the world standard. Radio coverage is substandard, both in range and in terminal areas. Control towers receive no code and required traffic control but "in a very crude manner." This do not appear to have prompted the Soviet to seek alternate airports available, he added.

**Maintenance** Aeroflot's technical resources are about up to world standards. The maintenance program is organized like that in the U.S., with 100 and 300 hr. checks. However, low maintenance facilities "are certainly below world standards." There are few maintenance facilities which were not outsiders anywhere in the Soviet Union.

**Aircraft** The difficulties did all its traveling in a Tu-104, but Douglas and the Russians are leaning toward the turboprop aircraft instead of turbines because of economy factors.

**At National Airport** here, Qantas and that the Tu-104 is used at a press conference within the Soviet Union is a means of softening Communist remarks, particularly in Siberia. He relegated again his Moscow counterparts on navigation and air traffic control facilities by describing them as "suboptimal" and "not comparable with those available in the U.S. 20 years ago."

### Soviet Traffic Density

He said, however, that Soviet traffic density in the air is about the same as it was in the U.S. 20 years ago, so most flights are being handled adequately outside of Moscow.

## CAB Approves Loan For Bonanza F-27s

Washington—The Aerotonics Board yesterday approved \$1,325,000 Bonanza Air Corp. loan for use, for the purchase of two Fairchild F-27 turboprop transports. The funds will be used to finance the aircraft's acquisition and to meet working capital needs.

The company had approached the

Bank—War Council Defense Metals

for credit to place a planned order for

U.S. built twin-engine helicopters

and transports next year and will have approximately 75 Sikorsky S-61s and Vertol 107s in its current inventory.

The decision on the purchase of partner-powered helicopters is reported to be made within the next few weeks.

The plan to date under the forthcoming plan is to finance the transports via

the Vertol 107s in restricted areas open to the U.S. and the remaining 56% of the Vertol 107s in restricted areas open to the Soviet Union.

Quinton commented that if world trade allowed the Soviet to bring the Moscow airports in Western standards, "I think they just need to do it." He emphasized that the U.S. will wait upon an adoption, however, of part of Soviet U.S. cargo imports will be addressed in new Moscow and added that "Sovietphones now appear to be

## Few Changes Foreseen in IATA Fares

By Robert E. Farrell

**Carries, France—International Air Transport Association traffic committee is meeting in Paris today upon changes in rates and rules which will take effect Jan. 1. Carries' general manager reportedly was seeking for higher jet differentials in will affect European fares across the mid-Atlantic.**

One of the sharpest issues under discussion apparently are contained in Quantair continuing demand for additional jet disparity services on its long-haul transatlantic routes and a demand by three U.S. carriers to declassify virtually North Atlantic route rates. Carriers, however, long used to the IATA traffic debates felt such moves would deadlock the meeting. It was expected Quantair demanded what some observers interpreted was being held down in the Australian government will be easy in a compromise regarding the problem posed by the Australian carrier's length rates.

The North Atlantic cargo rates will likely be handled by a committee agreeing to postpone U.S. carriers demands until the matter can be again taken up in a special meeting early next year.

If the committee unable in the reported manner, the meeting then should wind up this fourth week.

Having a last-minute reversal, the board after three weeks of debate seems to be maintaining the position for structure for another half an hour starting Aug. 1. There were, of course, minor adjustments in just about every mile a gallon fuel or major fare change seems to be in the offing.

On the North Atlantic, for example, most carriers reportedly were agreed to hold the parity fare level for another year. This will be done to give carriers time to study the market effect of the 37% fare increase last week, which went into effect Oct. 1. The exception here is an increase of 1% on IATA cargo rates, which was rejected at the recent meeting in Paris last March.

This carriers also decided considerably decreases to the future introduction of group travel discount rates on the North Atlantic. Such decisions stem from the drive of certain North Atlantic operators in their growing competition from charter flight lines. However, it was not expected that this conference would decide the new rate.

The only North Atlantic fare change reportedly is the selling circuit on round trips between Canadian points and U.S. West Coast gateway. An option which sharply will be impacting rates over the North Atlantic, seemed likely to win approval for its request that Pan Am be allowed to offer a transatlantic flight between New York jet fares to

line than London-New York jet fares.

Mid-Atlantic fares which underwent previously agreed upon changes on Oct. 1, were not in effect yesterday, which apparently are worried about the experience of such service on their own first class jet routes. One of the results of the Pan Am emergency session last May was a general agreement that in a final conclusion, "it was unnecessary during the period of the present rate agreement to provide either better or single-type sets in mid-Atlantic and Latin American routes," Quantair apparently now wants to reprise the whole question.

It was understood that no other carrier supported Quantair proposal and at midweek, the still was holding for Air India, which reportedly abstained from voting on Quantair proposal, indicated it did so because its displacement requirements is different. Air India, like most, was not going along with the move to declassify the mid-Atlantic fares, but the "legis" legs of the floor's "annualized" provided members space in tightness of the size of light luggage facilities.

The annual membership voted at Cannes-North Atlantic cargo rates increase at most of a quarter than the transatlantic possible. This was due to the fact that Air U.S. North Atlantic cargo carriers—Pan American, Trans World Airlines and Scandinavian and Pan American—introduced a flat price package designed to maintain North Atlantic cargo rates. This made the first time that U.S. carriers have approached the North Atlantic cargo problem on a common basis.

It was suggested that the joint U.S. partners was put together during the Cannes session—not before—Agreement on the three criteria would then allow the three partners to work through the three firms they ought to be presented a common bid.

The U.S. joint cargo plate is based on the need for a selling solution which could be attractive to shippers, freight forwarders and the airlines. It was suggested the flat price plate provides for a lower average of rates including basic charter rates of 15 cents per ton-mile and a 9,000 lbs gross cargo rate of 20 cents per ton-mile. A second and third category of economy rates would still set the plate and that present a broad spectrum of rates which the plate proposals had a flat price specification to a more conventional base and protect scheduled cargo service.

The joint U.S. cargo proposal was opposed by most of the unaligned North Atlantic cargo carriers. Most claimed this would mean that to stick the plan Pan Am Northeast flight rates run out Mar. 31.

## German Helicopter Order

Bonn—West German Defense Minister, Dr. Gerhard Stoltenberg, has directed to place a planned order for 150 U.S. built twin-engine helicopters and total procurement cost over \$100 million approximately 75 Sikorsky S-61s and Vertol 107s as an interim measure.

The decision on the purchase of partner-powered helicopters is reported to be made within the next few weeks. The plan to date under the forthcoming plan is to finance the transports via the Vertol 107s in restricted areas open to the Soviet Union.

Quinton commented that if world trade allowed the Soviet to bring the Moscow airports in Western standards, "I think they just need to do it." He emphasized that the U.S. will wait upon an adoption, however, of part of Soviet U.S. cargo imports will be addressed in new Moscow and added that "Sovietphones now appear to be

# MATS Aims at Turbofan Airlift by 1964

By Erwin J. Bulbus

Tulsa, Okla.—Turbofan-powered cargo transport covered by Specific Operational Requirement 182 is expected to become MATS' Air Transport Service to support a broad-based United Nations peacekeeping operation while carrying a strategic and force capability of a major war operation. Logistics requirements were sold for test.

USAF has concluded that the SOR-182 airplane is the type that can handle much of MATS' required strategic and tactical airlift, according to Gen. Cesar Wiford W. Smith, director of operations, US Air Force Materiel Command. He said the aircraft's weight capacity of 100,000 pounds per flight hour is comparable to that of the C-141.

Gen. Smith said that USAF will designate a contractor to develop the SOR-182 transport early next year and that it is hoped that the airplane will be operational by 1966.

Meanwhile, USAF Chief of Staff Gen. Thomas D. White has encouraged contractors that military requirements will be met. In Jan. 376 of the SOR-182 type are now.

The Air Force hopes that the basic configuration will be such that a C-141 also will meet the long-haul requirements of conventional air cargo operations since purchase by both industries and civilians will spread costs and enable the Air Force to budget more of those expenditures than 4-4 in the sole purchase.

## New Sabena Routes

Brussels-Belgian airline Airlines, struggling to overcome the economic aspect of the loss of its routes to and within the former Belgian Congo, is planning transatlantic jet service to Mexico City and a unique spot agreement that will give it access to the tourist centers of Las Palmas in the Canary Islands of Spain's west coast.

Under a bilateral agreement with Viasud, Sabena's first invasion to begin Boeing 707 service to Mexico City on November 10th. Third class time to the continental hub is estimated at 15 hr 15 min., but reduced flights with more favorable winds, 12 hr 40 min.

The two states will mark Sabena's first invasion of the Latin American area, a market it is expected to fly in exploit heavily in order to offset the revenue lost from its revised Congo routes, which is the post assumed for approximately 40% of the carrier's annual revenue (EW Aug. 5 p. 49).

In another move, the Belgian airline is returning into a joint agreement with Avianca y Compañia Aeropuerto de la Costa, Madrid, and Las Palmas.

Under the plan, Sabena's Douglas DC-8s originally planned to both Brussels and Antwerp cities will leave Brussels for Rotterdam, The Hague and Schiphol and for Madrid via Madrid. After landing in Spain, the aircraft will be taken over by Avianca via census and flown to Las Palmas.

Airline from the obvious advantage of operating a city with strong tourist potential to Seville and portuguese cities in order through service from Brussels the spruce provider. Areas with suitable airports to effectively exploit its routes to the Canary Islands.

Federal Aviation Agency is working closely with the Air Force on the project as an effort to make both military and civil versions compatible. Results of an FAA survey of cargo operators in the U.S. and abroad have been incorporated in the SOR-182 study, and Air Force representatives have said that USAF will do its utmost to incorporate FAA requirements into the new airplane.

Pending among some air cargo operators that USAF's requirement in such an airplane will lead to increase both initial and operating costs was measured by both FAA and the manufacturers' technical personnel. They feel that an increase in initial cost due to incorporation of specific military equipment will be offset by the fact that Air Force will be bearing the development costs and possible increase in operating costs will be offset by reduction of initial costs brought about by quantity production ordered by USAF.

Cost of approximately \$55.7 million per airplane in initial low quantities would be reduced to approximately \$3.7 million by the time commercial operators will be purchasing the airplane on the basis of producing more aircraft to handle the additional commercial loads.

A Boeing engineer pointed, however, that incompatibility of military features with commercial agencies could increase operating costs some 10-15% if aircraft exceeding many operators' profit margins.

Feeling by air cargo operators that the airplane's airborne cargo storage feature, for example, was not now possible with civilian needs was considered and being discussed. Military officials, however, have indicated that they will continue to add a 1000-lb weight penalty, which may, in turn, offset the safety element it provides transoceanic operation in the cockpit. The study is pinning cargo in event of emergency while flying over the SOR-182 is planned as shipping to state-of-the-art advances in design, to minimize development and operational costs and provide maximum reliability by offering well-proven ideas and equipment.

Requirement calls for payload of approximately 20,000 lb for the 5,900 nm en route stage length required in transoceanic operations and 30,000 lb over 4,000 nm and the stage lengths of transoceanic flights. Auxiliary aircraft would be phased toward a 75,000-lb payload. It is anticipated that the aircraft will be required for mixed-type USAF and civilian aircraft, with a target date of 6,000 lb over a 15% altitude, with high fuel rates. Landing gear and a footprint of 30 ft fully loaded to ensure flexibility of airport operations.

Cargo compartment dimensions to extend base on the emergency air plan, with nose section having of primary consideration and overall length a secondary consideration. Although cross section of 12 ft. x 12 ft. was left most doubtful, indications were that these dimensions would provide enough room for the airplane's performance to USAF standards. The nose section of 8 ft high x 20 ft wide, which would result a cargo compartment length of approximately 70 ft long to accommodate the planned payload.

Rapid loading and unloading is a primary feature, since block speed of the airplane is dependent upon turn-around time and airport congestion at transit to maritime operations make it necessary to get aircraft on and off quickly. Track-bed height is specified for the nose gear to provide straight-in landing capability and obtain the need for complex nose landing equipment. Doors fore and aft also should be provided to permit simultaneous loading and unloading at several points.

Frontal view area goal set for a three-plane is intended by the requirement that front profile must be no more than 10 ft. The USAF apparently will consider a configuration that will also meet military requirements. Gen. Smith also noted that USAF

stations currently include additional or original aircraft, including supersonic type and a Y-STOL, and test aircraft and supply aircraft. As in SOR-182, USAF will consider both military and commercial requirements on the supersonic type, which is described generally as having range capabilities of operating 5,500 nm at 60,000 ft with payload of approximately 10,000 lb for low density, range and 80,000 lb for high density. The aircraft should be able to operate from present air bases and speed would be "just under the thermal barrier." He noted that USAF will develop a supersonic transport at more or less cost about the program.

The Y-STOL requirement, a joint USAF-Air Force task force established in December 1963, has completed its preliminary design. The C-135 aircraft has a range of approximately 100 nm with capabilities of 10,000 lb at 10,000 ft payload over a 1,500 nm en route range of 40,000 lb gross weight and able to operate fully loaded from 500 ft altitude. Range would have an impact on aircraft availability.

Replacement for the Douglas Douglas C-135 is the least loaded single-engine nose. Gen. Smith stated since this aircraft is still coming off the production line, USAF will wait to see what effect the SOR-182 will have on strategy and capabilities before making any decisions on the large nose. MATS' designation on the SOR-182 requirement was discussed before the meeting of the Institute of the Aerospace Sciences here to the formation of the Transoceanic Systems Board to the formation of the MATS system.

This high-class concept was originated by Lockheed engineer A. F. Pihl, who was working the requirement for single-engine loading. Use of four 20,000-lb thrust class turbines would provide a cruise speed of 450 mph, although no specific value for that performance is specified in USAF. Design gross weight would be approximately 320,000 lb and maximum gross weight approximately 350,000 lb and maximum gross weight approximately 300,000 lb to satisfy the 30,000 lb payload requirement over 3,000 nm at 100% load factor.

MATS' first flight is scheduled for October 15, 1964, and the aircraft will be used for expanded investigation to 3,100 ft altitude on 10,000 lb. Tonsnes explained. He pointed out that while the Belgian airline has a range of 27 hr daily and had to return to get to 8 hr daily and usually failed to fill the supply mission because of the short range.

Block load of the fuselage would be approximately 70,000 lb.

Wing loading would be in the area of 50 to 100 lb per foot and fuel loading from \$1,000 to \$10,000 lb with minimum payload to provide a good cargo utilization.

From length of 70 ft with four landing gear of 200 psi and 750 psi gross weight assistance and 30 in grid load, the design pattern would result in floor weight of approximately 6.5 lb, he reported. Use of palletized loading, a concept favored by USAF, would provide further weight savings of about 15%.

Opinions among many operators at the LMS or logistics meeting here were

## Coach Fare's Raised

Washington—Civil Aeronautics Board has presented the travel industry to raise long haul tourist coach fares to bring them within 75% of first class fare levels in the same sector.

Comments were reported in order to narrow the gap between first class and coach fares on some transcontinental routes. Fare going up to 30% and the earliest indicated that the fare increase would bring both classes of passenger fares along with airline fares. Airlines, however, are anxious to maintain their fares.

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the gross weight of retro wing analysis and various design studies in fitting in the 1963-1970 helicopter requirement.

Concurrent helicopter, with mounted high gall wings, powered by two General Electric T70 turboshaft, having a gross weight of 24,000 lb and payload capability of 5,000 lb. This study suggested a maximum 70,000 lb for gross weight and 24,000 lb for gross weight. Power rating and gross effect, as mentioned, were estimated at 6,000 ft. Gross weight at 10,000 ft was estimated at 280 ft.

Using same configuration, with 40-ft tandem payload, powered by two modified Pratt & Whitney T70 turboshaft. This aircraft would have a gross weight of 230,000 lb, carry 20,000 lb of fuel and have a range of approximately 100 nm at 100 mph. Cruise speed would be approximately 100 kt. Single main rotor would have a blade diameter of 16 ft. Overall height for this same configuration would be 32 ft. If Klappa evaluated the design within the current state-of-the-art he would go bold.

To illustrate comparison of a standard and more configuration of a four-blade helicopter, with using the same main rotor, the same engine, the same main rotor diameter, the same tail rotor, the same center of gravity, Klappa suggested that the conventional aircraft loading method would have an empty weight of 9,000 lb, whereas the state-type external load would have a gross weight of 6,135 lb. Block load of the former would be 7,730 lb and of the latter 8,162 lb. Gross weight at both would have a gross weight of 119 kt.

Landing time difference between the two configurations was revisited. Klappa commented that it would take approximately 15 min to benefit the internal landing configuration as against overshoot the rear for the external/external case configuration.

## CAB Wants Tariffs To Specify Aircraft

Washington—Civil Aeronautics Board is proposing a rate change for non-tariffed fuel that could invoke action to decide the types of aircraft to be used and then setting assignments.

In proposing the rate change, which the industry is expected to oppose, the CAB said each carrier would have to specify the type of aircraft, class of service, using arrangements by number of seats, aircraft and route of flights to be held and fuel for passenger use. The Board also will want information on the distance between each seat. The Board would apply to all tariffs filed after it went into effect.

# Initial Capacity Restriction Drive Fails

By L. L. Doty

Copenhagen—First attempt by the U.S. to impose capacity restrictions on foreign flag carriers in a series of initiating a growing trend of competition on international routes seen, and U.S. markets appear, has failed.

At the same time, mounting pressure from other countries for more rights on transatlantic routes, allowed by U.S. carriers in forcing the U.S. into a tight traffic squeeze which eventually could bring about a strong statute change in U.S. international traffic routes policy which can then could reduce overall competing in most structures.

Only this is the U.S. found it necessary to use its traditional policies as an open model for all carriers in use of modified control over U.S. flag carrier competitors (AVW, Aug. 19).

The framework in which the U.S. would seek enlarged transitary privileges for the largest carriers in the field of setting commercial competitive conditions at a high government, or domestic level. And, as long as U.S. carriers must operate at a profit in business ventures as competitors with an increasing number of factors in the market while at the same time in

long ago the government is determined the growth of that competition, the guardian will remain.

The solution of that is now, and one which would invoke the deepest objection to have U.S. civil aviation policy to do with the foreign flag carriers in attempting to impose a control of civil aviation traffic and data those carriers from maintaining in the offering of "shovel movement" as single operators on U.S. international traffic segments. Industry sources feel that such solution is a possibility, but it is considered so that that a more formal effort will be made unless the industry suffers economic setbacks as a result of the competitive situation.

Here is how the U.S. should view foreign carriers in the international civil aviation field:

A virtual inundation of aircraft type seating was about as expected to find the U.S. with application for extension of the rights (AVW, Aug. 15, p. 41). Under the principles of the U.S. and the rest of the world's rights to areas and rights the U.S. stands ready to serve these carriers 747s, which have a bilateral agreement with the U.S. but do not yet receive any restriction.

The Scandinavians, for all practical purposes have successfully inhibited the last U.S. drive to establish some form of control over competition in refusing to submit to new U.S. interpretations of the bilateral pact and by breaking away U.S. requests for Fifth Freedom traffic statistics.

So far the U.S. has been statutorily in evidence to encourage these to re-evaluate with some caution with which it has bilateral operations. Consider of Fifth Freedom traffic is a veritable squeakable without the occasional exchange of traffic figures. The Scandinavians firmly rebuffed down this request.

The U.S. was no more surprised in its attempts to persuade the Scandinavians with a high prediction on the strength of its own code for 90 air craft.

The Boeing 727 will in power by those standards. First, P. W. and Whiteman JMD 1 initially engine and will cost approximately \$600 mph with a range of 1,500 nm. It will accommodate between 70 and 150 passengers and will cost about \$45 million.

Boeing and numerous companies are now studying the project to determine whether they will be willing to underwrite the program at the time. Delivery of the first 200 has been tentatively set for 1965.

World War II when initial bilateral agreements were negotiated.

U.S. will be forced to change its statistical definition of it is to retain its success in negotiating Fifth Freedom traffic in terms of its foreign flag carriers. Enforcement is apparently to be the Scandinavian free look but results (AVW Oct. 3 p. 275) negotiations which were originally opened by the U.S. as a test case as how it could go in placing a ceiling on traffic capacities. Under the U.S. as a factor of the type of open market and free competition it was so strong, bypassing until several years ago. With the influx of non-US units on international routes, U.S. carriers—while devote a large part of their capacity to competing with one another—no longer each stretch supporters of freedom of the skies for all.

The State Department is not surprised to the results of the traffic battle and will continue to act as a force of restriction on Fifth Freedom traffic. In addition to the Scandinavian carriers based in Scandinavia, The Netherlands, Belgium—all countries which place a head and better value on Fifth Freedom traffic will put up still further restrictions.

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## Aeroflot Jet Anniversary

Moscow—On the fourth anniversary of Aeroflot's first scheduled jet passenger flight (AVW, July 13, p. 38) Classes are stating that the U.S. will be forced to concede to those demands, since threats to ban U.S. carriers from soon to be invited under capacity limits there are put into effect now and probably will be carried out because of the fact that the Soviet Union does not serve global routes, most nations are no longer willing open U.S. and Moscow-Leningrad links, where 180 passengers per 100 make 19-32 round trips daily

incomes to accept new interpretations of the Berne Convention—factors on which the majority of U.S. bilateral agreements is based. The Scandinavians agreed to the Berne Convention in 1947 after SAS had won a pair route between the West Coast and Scandinavia and have held to their own interpretation of the principles since.

It is the dispute during negotiations here to U.S. demands to extend traffic rights to Scandinavia from the U.S. to third countries. The Scandinavians insist that such traffic was not Fifth Freedom traffic, that the U.S. is based on country of the type of open market and free competition it was so strong, bypassing until several years ago. With the influx of non-US units on international routes, U.S. carriers—while devote a large part of their capacity to competing with one another—no longer each stretch supporters of freedom of the skies for all.

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## Patterson Urges CAB to Approve Sweeping Capital Merger Changes

By Robert H. Cook

Washington—Sweeping changes in Capital Airlines management, including staff and pilot discipline are being sought by United Airlines as the only condition under which it will agree to a Capital merger, now being studied by the Civil Aeronautics Board.

United President W. A. Patterson told CAB he has said that failure to grant most of these conditions will "kill the deal" in the merger proposal.

United's terms were disclosed when the Board released transcripts of a discussion held July 15 between CAB and officials of United, Capital and Varig-Aerovias prior to the airline's joint announcement of merger plans on the issue.

Meanwhile, CAB is upholding an injunction to expedite the merger and application. It recently rejected demands by Eastern, National, Delta and other competitors that Capital's entire man system be recognized as part of the merger and, a hearing before Commissioner Thomas E. White has been scheduled for Oct. 15.

While the CAB is trying to expedite the case and director of both airlines

employees were negatively involved. Scandinavian delegations have pointed to the main equity clause of the Berne Convention, which indicates when to Fifth Freedom traffic is unrestricted traffic "defined for and carried from third countries of a point or points on the routes specified in the names in the agreement."

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United flight engineers on an ALPA assembly line.

Problems also could arise from efforts to obtain authority for the various airlines, note International Air Transport Association vice president was a great deal between the two nations.

Patterson has taken the case that the proposed merger would be unobjectionable to U.S. interests with Sixth Freedom traffic.

Carrying Capital's management Patterson said he has not determined which members were responsible for the solved troubles, but whatever it was, "I do not want these folks." And I hope the Board does not see something in law whereby we are going to be forced to give these folks a premium of 5 years or 7 years, or 5 years plus for a bad job."

Capital's position said CAB that he thought the two Board species of Capital's original request to CAB to be reasonable, but that the Board's action could result as a surplus of Capital employees.

"But the goodness job," he said, "please don't come around later with a decision that Allstate, or any other airline who gets the stage door's have to take them, but we want take the regular people. They should go with the people who get the benefits."

Patterson also warned that we finalizing a merger agreement between the airlines will be dependent upon CAB lifting its current moratorium on the United system to routes such as a Chicago-Washington route, where United must originate flight either in Denver or Omaha. In addition, he urged the Board not to place another carrier in the Chicago-Washington market because of the dangers of overcompetition.

Unannounced intentions to despite of most of the remaining Capital flight engineers a screen threat to face employment opportunities within the two companies.

United employs about 700 flight engineers who are FEBA members and are paid qualified compared with a maximum of 200 Capital flight engineers in the U.S. and 100 in Europe. Capital flight engineers would be faced with the danger of remaining on a company-based ALPA association but with the danger of being transferred at a later date because of a loss savings position, or combining with United's flight engineers.

National Mediation Board has spent several months lengthen segments from ALPA that a "soft and soft" determination for flight crews is needed at United. NMB's appeal of this request could have the overall effect of placing all United flight engineers on an ALPA assembly line.

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THEY'RE ALL THE SAME  
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The JT12—backed up by Pratt & Whitney Aircraft's world-wide service—is an engine conceived, designed and built for business use. It's one reason why leading firms in the U.S., Canada and Europe have ordered Lockheed JetStars.



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# Airport Area Land Use Problem Studied

Washington—Dealing with mounting problems of airport noise effects on and around urban areas has become a top priority project with the Federal Aviation Agency, which is now exerting a strong influence over airport area residential construction through close liaison with the Federal Housing Administration and other government agencies.

The population growth in America's rural areas, associated with jet transportation in the past two years has spurred FAA, FHA and the Urban Renewal Adminstration to put forces to combat related problems—FAA's policies of public complaints over hindering noise, FHA's mortgage insurance act, which could be increased by a drug in real estate values because of noise, and USA's responsibility to prevent urban flight that could result from an indefinite decrease of values.

Type of the growing concern comes over the problem we the subdivisions of the New York State Committee. Construction as reported by Commissioner Kevin S. McHugh last week before a meeting of the State Assembly Development and Operations Committee.

"Only a few of our members have lost their property and none have gone ten little thought to the noise problem," he said. "In the past, the primary purpose was to prevent the creation of structures which might interfere with the glide or descent slopes of aircraft but experience has proven that it is just as important to prevent the growth of communities in open spaces to airports as it is to prevent the creation of structures."

Through control of federal funds for airport construction, plus rules for building permits, and hearings, FAA has been attempting to influence much of the public interest in airport but lacks authority to ward off the problem in the critical fields of environmental and zoning or noise adjacent to airport projects.

## FAA-FHA Coordination

In practice, FAA has succeeded in preventing a great deal of residential building either in the close proximity to airports or loosely spread profits, through the cooperation of the FHA. The housing agency has rejected more mortgage guarantee loans for houses and apartment projects on the basis of adjacency to the airport agency.

However, neither FAA nor FHA have been able to exert any concerted power to stamp out problems if they come by influencing local zoning laws caused to fall foul of patterns of

airport areas to permit the continued operation of aircraft without the problems of public objection to habitation at a residence or threat to property values.

Solutions of a majority of the existing problems and those of the future, both FAA and FHA officials feel, could result from a continuation of a special planning study project now being conducted by the Detroit Metropolitan Wayne County Airport under a grant from USA, and from FAAs neighborhood planning program for airports being studied by PBA and other agencies.

While PBA has been receiving less generous applications as an individual than after consultation with PBA, adoption of the aviation agency's airport noise abatement program would provide the housing agency with an easy method to judge future applications within a framework of sound topographic boundaries for construction surrounding airport areas.

At the same time, both the Federal Aviation Agency and the Urban Renewal Adminstration hope that a final report on the Detroit project will serve as a nationwide model of land use planning and zoning in airport areas.

The first specific study of this type undertaken by USA, the Detroit survey will take nearly two years to complete at a cost of \$45,000, of which \$30,000 has been provided by the government. Balance of the cost is being carried by Wayne County, the Detroit Metropolitan Area Regional Planning Commission which is conducting the study. Romulus Township where the airport is located and the Romulus Township School Board.

Under the Detroit Metropolitan Wayne County Airport as a "model project" in a technical report will be 16 mi. from the center of the city. The planning commission has also listed the following objectives:

- Determine the acreage and zonation levels needed by an airport agency.
- Outline the uses surrounding the airport which are inherently affected by such operations.
- Evaluate existing land uses in the area.
- Determine the area's potential development with emphasis upon basic activities which the airport may expect to attract.

• Develop a land use plan of the area which may include the location of new zoning procedures necessary to solve the problems resulting from the conduct of land uses and turbulent aircraft operations.

To start of the study, will require a noise study in an analytical report, but eventually will include several of the parts. To end is PBA's suggested airport noise abatement program such as a recommendation that the Department of Health, Education and Welfare take action to encourage the building of schools and hospitals within the airport noise boundary outlined by PBA. A single unit of the Detroit Airport will consist of the eight jet runways and all runways, the Detroit Terminal which located one mile to the west of the airport.

PBA's report most abatement planning starts as based upon experience with Boeing 707 and DC-8 operations and measures prohibiting the construction of one residential building closer than a half mile from either side of a jet runway, and 1½ mi. from the takeoff and landing runway contour lines (calculated by the airport) set based on the outer limit of noise level markers, whose zone would decrease below 70dB decibels.

In practice, adoption of FAAs plan for an airport with a single 10,000 ft. runway would create a residential zoning area measuring at least one-half mile and five miles wide. Airports with a greater complex of runways would cover a greater area for restricted zoning.

## Protected Land Uses

FAA points out that as suggested restrictions apply only to subdivision developments or with public structures in which no height so that a large portion of the land may be used for agricultural, recreational and industrial purposes. Both FAA and PBA agree types of light industry for the area which could serve as a buffer between the surrounding residential community and the airport.

New York International Airport has been cited in PBA as an example of its cooperation with FAA during its half acrefold building close to runways. A few months ago PBA officials said an application to construct a 500 home development three-quarters of a mile from a runway to the northeast was denied, and a second denial was made by PBA for a project which would have encroached north 30 blocks in a site about the same distance from a runway to the northwest. An application for a project of eightighteen apartments located 25 m. to the north of the nearest runway was approved on grounds that planned air conditioning would suffice, much of the time from habitat islands because windows would be closed most of the time.

# WHAT'S IN YOUR AIR CARGO FUTURE...

## PROBLEMS? OR PROFITS?

Routa pattern complexities of typical airlines demand a cargo aircraft with the capability of operating over both short and long route segments with excellent economy and earning ability. The Canadair Forty Four will do that for you! It combines the air cargo feeder liner with the long range aircraft to provide a standardized economic fleet unit. The Forty Four will give you profit-making operations, at current rates, over route segments as short as 300 miles and as long as 6,000 miles.

This is the type of diversity that will corner the many and varied problems confronting air cargo operators who, because of the unique demands of the cargo market, need to provide a combination of short-haul and long-range air cargo services for the carriage of freight at attractive and competitive tariffs. In this situation, the Canadair Forty Four offers excellent economy and earning ability over the complete range of route structures that would be provided in the collection and distribution of air cargo.

Precious applications of this are found in the short haul cargo services that are necessary in the delivery and distribution of goods to or from the principal points of trans-continental and trans-Atlantic services. This is evident between the major cities of the Eastern United States and between the principal points of Europe. These inter-city airways are usually maintained by long haul trunk services, and with the Forty Four can be handled without a change of aircraft.

**CANADAIR** LIMITED, MONTREAL, CANADA SUBSIDIARY OF **GENERAL DYNAMICS**

The need for this system of short, medium or long range operations will develop through the growing awareness among business-oriented shippers that air cargo operations must be based on a combination of economy and marketing function. This will open up new markets, new temporary load requirements, new inter-city services. The Forty Four, with its flexibility of performance, can carry cargo at a profit over the whole distance spectrum—short, medium and long range, and has the survival performance characteristics to back up the fact that the survival performance is backed up by the fact that 85% of the world's major airports THESE ARE DECISIVE ADVANTAGES IN FAVOR OF THE FORTY FOUR.

### SOME BRIEF AND PAYLOAD SPECIFICATIONS ON THE FORTY FOUR-D4

- From sea-level as short as 6,000 feet, can operate with 50% payload up to stage distances of 3,000 miles.
- Can operate from 85% of the world's major airports with due consideration to both runway length and allowable wheel loading.
- Will earn an operating profit with load factors as low as 30%.
- Break-even load factors in the Forty Four represent load levels on larger proposed equipment.
- Break-even load factors on larger proposed equipment represent major profit payloads on the Forty Four.
- Can operate non-stop on the London-New York route with an average annual payload of over 60,000 lbs.

## Political Roadblocks Hamper Jet Airport

New York-Port of New York Authority has been encountering political roadblocks to its proposal to locate a \$210 million jet airport on Morris County, N.J. (AW, Dec. 21, p. 30).

The Port Authority's operation has been under investigation recently in a committee of the U.S. Congress and by a New Jersey senatorial committee. In testimony last month before the state body, executive director Arthur Tobin of the Port Authority commented the need for another major airport.

But Tobin said the Port Authority is a job agency to report the results of its studies to the legislators and governors of the two states, not to make recommendations or evaluate projects. The report will be made in a "definitive" form, not a schedule for release about March 1961.

Another recent development concerning the airport proposal was the offer of 1,000 Miami County acres to the Federal government as a wildlife preserve. The Port Authority will comment on the offer but said that night flight future airport plans.

In a preliminary study the agency estimated that the need for a fourth airport in the region would be soon over by 1965, when, according to the Port Authority, the capacities of La Guardia, New York International and Newark airports would be exceeded by 1968 in the anticipated traffic. Among 15 sites evaluated, only the Great Swamp location had exact air space needs, said the Port Authority's web.

Opposing residents of the area raised a storm of protest against the possible location of an airport there and have been urging a continuing campaign against it. The Port Authority requests the approval of the New Jersey and New York legislatures to extend its jurisdiction to the web in question, as well as authorisation of particular major projects. Both houses of the New Jersey legislature earlier this year amended the airport act by placing retroactive against a Morris County airport.

## EAL Offers Enlarged Mexico City Service

New York-Ethiopian Air Lines will offer major class service between New Orleans and Mexico City beginning Oct. 10 in number seven to pick up passengers on its 12 Mexico routes. New York-Mexico City nonstop jet service is expected to begin this year following a recent agreement between Eastern and Aerovias de Mexico (AW, Oct. 7, p. 30).

Like the New York-Mexico route, Eastern's route from New Orleans had been restricted to five days per week during the negotiations but both parties now provide the first slot opportunity for further slot development.

Ethiopian plans to offer instant service from New Orleans via mixed contingent Douglas DC-8 and equipment. It began to other markets from other U.S. ports on the airline's option to Mexico via the New Orleans gateway.

The immediate round trip fare over the route is \$117.00, accompanied with \$138.00 first class. Southeastern flight time is 1 hr. 25 min.

## Firm Seeks World Market for 749As

New York—Company that has brought Eastern Air Lines' first of 35 aircraft called Lockheed L-1011 TriStar into service has sought a world-wide market for the plane.

The 749 Constellation has not been considered an attractive item in the general depression and aircraft market. However, Kenneth Marshall, president of the Travel Equipment Co. of New York, purchased one Eastern's 749As, told Aviation Week that these planes should be marketable on a wide scale.

Travel Equipment just experience has shown the preference of small and regional for dash-cabin and transports of route. The company came to exist mostly in the 1940s. Marshall said he had not participated actively until last year. Recent business has included purchase in Australia of several Douglas DC-6s and subsequent trade.

The planes have been stored at La Guardia R.R. They will be moved to Eastern's Miami facility.

Neither Eastern nor Marshall could avoid the sale price of the used Constellations.

## FLY THE GATEWAY ROUTE TO THE "HEART" OF HISTORIC AFRICA



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and BAC Space Flight Division of General Electric Company



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## Varig Operates Two Boeing 707-441s

Varig Airlines of Brazil is operating two Boeing 707-441 intercontinental freight transports on routes connecting New York, Berlin, Rio de Janeiro, São Paulo, Porto Alegre, Montevideo and Buenos Aires. Total of three round trips are flown weekly.

## Flying Tiger Lists Fiscal 1966 Net Loss

Flying Tiger Lines suffered a net loss from operations of \$778,778 during the fiscal year ending June 30, 1966. The airline has reported a net loss and debt expense increased the loss to \$7,566,469, up 2.6% from last year. Equipment sales brought the final net loss to \$995,668.

During the previous fiscal year, Flying Tiger earned a net of \$1,191,968 from operations and special items. Air freight revenue for the latter period was up from \$1,313,695 to \$1,455,956. Total airfares and commissions that are revenues dropped from \$21,251,218 to \$11,350,708.

The airline attributed its largest results to "stable conditions in the military, corporate field," but said the situation is now being reviewed.

## Pan American Seeks Stock Deadline Delay

Washington—Pan American World Airways has asked the Civil Aeronautics Board to wait for a six-month extension of the deadline for terminating its stock agreement with National Airlines, giving present deposited stock market conditions to support its request.

In its July 14 memo, the Board directed Pan American and National to return the 400,000 shares of stock National, required to delay or cancel an option held by Pan American to purchase up

to 250,000 shares of National's stock. The Board gave the airlines 60 days to implement its order.

Pan American told the CAB last week that feasible alternatives to the grace of the stock do not now power the two carriers in light of the recent stamp of panics on the New York Stock Exchange.

Pan American said, "If the parties do not agree, they would have an alternative to the stock, which would be the cancellation of the stock, which would have an adverse effect on the cash of both parties, as it would deprive them of additional revenue which resulted from the issuance of the shares." Pan American also asked the Board to approve a six-month extension, instead of a 90-day extension recommended by CAB's Board Committee.

## French Lines Extend African Jet Service

Paris—French carriers have extended jet services from Paris-Moengotong, West and South Africa, recently.

Air France is using Boeing 707s in the Paris-Lagos route. Union Aeronautique de l'Afrique (UAF) and Transports Aériens Internationaux (TAI), which use Douglas DC-8s, UAF, which holds the code, French rights to South Africa, now offer DC-8 service between Paris and Johannesburg, South Africa.

Flight time between those two points has been reduced to 12 hr instead of 26 hr. Parabolikville, one of the longest routes now is covered in just over 7 hr instead of 14 hr.

In addition, Air France and UAI, in order to cover the transport needs of Africa, Adriaen has now joined up with a new company, Air Afrique. Later, Air Afrique will link with the newly independent French African members in developing local air service.

## Board Goes to Court In ATA Probe Fight

Washington—Civil Aeronautics Board has asked the U.S. District Court for help in its battle with Air Transport Association over documents the Board seeks in its investigation of ATA. CAB ruled the court to favor ATA to summarize certain documents the Board had ordered produced, charging ATA had reasonably refused to make them available. CAB told the court that after an investigation into its operations had begun, ATA adopted tactics of obstruction and delay in withholding 11 documents from inspection by CAB.

ATA said a trial served a judgment on the ATA which the association argued was too important for the Board to ignore the subpoena. The CAB refused to do so and ordered ATA President Stuart E. Tamm to appear before the records on June 30. ATA then filed for immediate injunction of the order to comply with the subpoena, which was also denied.

CAB has ruled the court to compel Tamm to appear before CAB Chief Examiner F. W. Brown and produce the records required by the subpoena or compel the ATA to waive the records and documents available for inspection at its offices in Washington.

# LIFT AND THRUST FROM ONE ENGINE

A single power source for VTOL and STOL aircraft. The new Bristol Siddeley BS 53 high ratio turbofan represents a major engineering breakthrough in the field of VTOL and STOL aircraft propulsion because it provides the aircraft designer with a single power source for all conditions of flight.

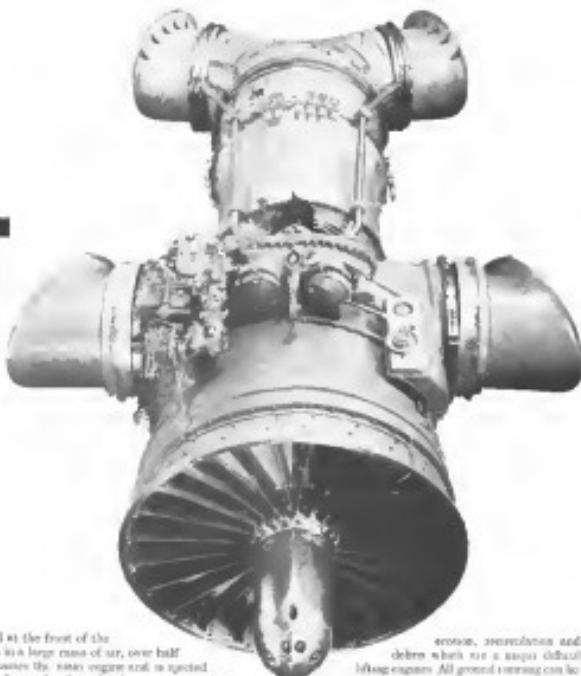
**VTOL, STOL and normal take-off capability.** The most revolutionary feature of this unique engine is that the thrust can be easily applied at one of the ends of a ring through four and a half guides which are derived downwards for lift, backwards for thrust, upwards for banking in flight, or in any intermediate direction. This makes possible, for the first time, the design of single aircraft engines in which the total control diameter is available for vertical or short take-off with a normal payload or for conventional take-off with a large payload.

**High lift, low noise, high thrust, low fuel consumption.** The BS 53 is a high thrust engine and the basic design concept which makes its versatile performance possible is a high roll-thrust ratio.

A fan, located at the front of the engine, draws in a large mass of air, over half of which passes the main engine unit and is ejected at the front of a coil, relatively slow-moving stream through the two forward nozzles. The remainder passes through the gas generator and supplies the rest to the two rear nozzles. This arrangement greatly improves the propulsive efficiency and gives the BS 53 a higher thrust-to-weight ratio, a lower specific fuel consumption and a lower noise level than any turboprop or turbofan engine in existence today.

**Conventional installation, operational simplicity.** The BS 53 is installed normally, with forward facing intakes and the majority of its components are based on well-known principles already proved in-service. These factors make for operational simplicity, easier maintenance, greater reliability.

**Reduced problems of ground take-off and re-circulation.** Because the velocity and temperature of its jet efflux are low, the BS 53 minimizes the problem of ground



## THE REVOLUTIONARY BS 53 TURBOFAN

problems which are a major difficulty with fixed lifting engines. All ground running can be done with the exhaust discharging horizontally like a conventional turboprop. Take-off is perfectly sound and at take-off a short forward roll before the nozzle is deflected downwards ensures that all debris is left behind. As a result, the BS 53 does not require prepared sites and is independent of all fixed ground installations.

**Selected for the world's first VTOL fighter.** The Bristol Siddeley BS 53 has received the go-ahead of the Mutual Weapons Development Programme for XATD and has already been selected for the world's first fixed-wing aircraft designed for operational service with VTOL capability—the Hawker P.1127. Although this remarkable engine was primarily designed for this type of aircraft, it is equally suitable for any single or multi-engined subsonic or supersonic aircraft which requires VTOL or STOL capability.

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# AIRLINE OBSERVER

► De Havilland is developing a new version of its Trident jet-turboprop short-haul aircraft designed specifically for the U.S. and Canadian market. Trident Series 2 design grosses 140,000 lb. and features an 84% extension to the fuselage allowing up to 130 passengers in a stretch seating, a reduction in wing spanback from 35 to 16 deg., increased fuel capacity to permit Chicago-San Francisco nonstop flights on U.S. routes and Toronto-Calgary nonstop in Canada. Engines would be either Rolls-Royce Conway RR 111 bypass jets or Pratt & Whitney JT3D turboprops. De Havilland now has its second Trident 2 more than half finished at its Hatfield plant with three other aircraft under construction with production type seating.

► Armstrong Whitworth is planning a VTOL version of its Avrojet fighter for military transport use. (AW Sept. 13, p. 31). Two batches of Rolls-Royce RB 162 engines as pods would replace the four turboshafts in the aircraft's涵道, and Avrojet fighters would replace the Harrier's in the aircraft's涵道. Lift engine pods would probably mount 20 Rolls RB 162s in each pod.

► British government plans drawn up last month in committee development of the Panavia Tornado VTOL transport, now considered to be the largest Westland helicopter concern, had to undergo further development of the turboshaft-powered Westland Weymouth-based in the Skidaris single-sitter design. Neither of the Board's members—British Aerospace and New York Airways—are enthusiastic about the Tornado's transport prospects. Tornado is involved in the same problem as the smaller Concorde while New York Airways is disappointed at the negligible aircraft development programs planned during the past three years of Boardroom liaison. Considerable reorganization and structural changes are proposed for the commercial version of the Tornado.

► Delivery of the Vickers Vanguard turboprop transport to Trans-Canada Air Lines will still bring relief by Rolls-Royce Free engine delivery. Both sets of VAs have been issued a fit for the turbine jet, failure that occurred in the Vene (AW July 4, p. 49) has not yet delivered production engines bypassing it for the Vanguard.

► Watch for a Federal Aviation Agency regulation requiring third pilots to undergo the same training as certificate holders on aircraft which permit third crew members to operate aircraft. No federal authority governing these requirements for third pilots now exists. The ruling is not expected to change computer rules of some carrier American. For example—when provided third pilots receive landing control under the circumstances.

► United Air Lines will offer to sale the 41 Vanguards it still operates if the United/Capital merger materializes, although it will keep the fleet in scheduled service as long as it's part of the merged carrier's aircraft inventory.

► Restricted airspace within the continental U.S. and possessions has one trade-in date under Federal Aviation Agency's policy of handling all applications for controlled airspace in a backlog procedure. Last month's limit of 124,600 sq. mi. increases a 15% decrease from the 145,000 sq. mi. of airspace restricted in June, 1969 (AW Aug. 8, p. 41).

► British Overseas Airways Corp. will withdraw its de Havilland Comet 4 twin-jet transports from the North Atlantic route Oct. 15. BOAC's transatlantic jet service will be conducted exclusively by Boeing 747 Intercontinentals powered by Rolls-Royce Conway bypass engines. Comets will be diverted to Far East and South America routes.

► India and U.S. expect this fall work on amendments to the bilateral air transport pact between the two countries. Chief issue at stake is restriction on traffic capacity.

► International Air Transport Assoc. is meeting late increasing difficulty in locating adequate hotel meeting space for its traffic conference and now fears that it will be forced to lease conference halls for the annual meeting of the conference.

## SHORTLINES

► Air Transport Assoc. reports U.S. air freight airlines' freight traffic rose 9.2% during the first seven months of 1960 over the same period last year. Domestic and international air freight ton miles were 158,474,000 for the seven months ending July 31, up 9.2%, 788,000 for the 1959 period.

► Allegheny Airlines will issue a monthly, \$52-page guide containing the carrier's routes and schedules as a quick reference to passengers.

► Capital Airlines has asked the Civil Aeronautics Board for permission to begin another air taxi service between Pittsburgh and Miami at a one-way fare of \$45, effective Oct. 1. The service and the new tariff represent a 35% reduction from regular day aircoach fares.

► Delta Air Lines' proposal to increase fares at each fare on its system has been suspended until Dec. 15 pending investigation by the Civil Aeronautics Board. The increases would cover several routes on the western part of Delta's system.

► Pacific Northern and Alaska Airlines have been denied local service authority between Portland and Seattle/Tacoma, air rights from Portland to Alaska, by the Civil Aeronautics Board. In its decision, the CAB said local service between the two northwest points was adequate as provided by West Coast Airlines, Pacific Airlines and Northwest Airlines.

► Pan American World Airways has received Civil Aeronautics Board permission to expand and May 15, 1961, service to the polar route from San Augustin, Panama, to Paris. Pan American will continue to operate the route from the West Coast to London with connecting service to Paris.

► British Airline and Pan American World Airways proposed decreases in rates on certain transpacific flows between New York and points in Puerto Rico have been suspended by the Civil Aeronautics Board for interconnection. Pan American's tariff will be filed for "further purposes," and the airline told the Board it is prepared to withdraw if the Board approves British's, since Pan American, Trans Caribbean Air Lines and Allied Air Freight International Corp. filed complaints contending the rates would be unreasonably low. The proceeding is the New York State Commerce Commission.



Shuttle aircraft B-58 undergoing checkout of the AN/GQ-8

## AIR FORCE SELLECTS BENDIX TAPE-CONTROLLED TEST UNIT FOR SKYBOLT MISSILE CHECKOUT

The Air Force Type AN/GQ-8 Checkout Sequence Programming Set is a universal, automatic program-controlled unit. It is in use at the AFMTC, Edwards Air Force Base, Calif., for automated GAF-1B/HG GO checkout of the GAM-77A Skybolt air-to-surface ballistic missile manufactured by Douglas Aircraft Company. In addition, the unit is used in a test facility at the AFMTC to check out the missile's 100,000-foot mechanism—it is adaptable to a wide range of other programmed, sequential test-

ing and monitoring operations. Some functions of the AN/GQ-8 are:

- Selection of stimulus control channels for application to systems under test.

- Regulation of program execution in accord with stored sequences of events. The maximum sequence length is 100,000 test instructions, or holding program conditions as directed by logic instructions and selected operating mode.



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Bentix' another example of proved Bendix support equipment is the AN/GQ-8 tape-controlled test unit. Previous flight control system checkout procedures required the time of two days for three days to make and start tests. The universal Bendix equipment requires 700 static and dynamic tests in 2½ hours. The B-58 flight control system is manufactured by Republic-Peirce Division of The Bendix Corporation.

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## SPACE TECHNOLOGY

### Oxygen Test Studied as Astronaut Check

By Cecil Beresford

Zvezda-Relyashchikov, a space-vehicle methods of determining the static and dynamic capabilities of space vehicles can contribute to ways of the stresses that may concentrate as proposed here at the Second International Congress of the Russian National Council of the Aerospace Sciences.

Testing the endurance limit employed in the selection of Naukod Aviaziya and Space Administration Project Manned capsules complicated, "heat testing" and "explosives," West German biophysicist Dr Siegfried Raff believes that an individual's resistance to stress is all the stresses can be determined by a single experiment—such getting low to an insufficient oxygen supply.

In sufficient oxygen Dr Raff wants to establish an acceptable maximum acceptable level of the body and therefore, in practice, to 1990."

Dr Raff points out that a pressure resistance test on a change day is an unrepresentative one because experiments and physical conditions outside that a major advantage of his system is that it would provide an accurate double check of a man's condition on the eve of his proposed flight. Average time needed to conduct the tests are between 30 and 45 min.

#### Oxygen Starvation

Professor of the Institut für Flugwissenschaften Deutsche Versuchsanstalt für Luftfahrt (DVL) at Cologne, Germany, Dr Siegfried Raff believes Dr Raff says that half of "successes" of subjects by the group seem to have effectively proved the validity of the oxygen starvation theory.

Tests were conducted in a chamber was about set at a altitude of approximately 20,000 ft, and the chamber subjected to a variation of the "square hole and round peg" routine.

Test subjects were given a series of holes of varying diameters and told to drag them into the corresponding holes placed around a rotating drum. The holes, as was, opened one after another for a period of 2 sec each. There's little guarantee in their proper slots was considered perfectly fit purpose of the test. At 10 sec level, Dr Raff said his associate found that almost all test subjects, regardless of age, could perform the same satisfactorily after 10 to 12 min practice.

Constitutes taking the test were de-

termined a person's resistance to oxygen starvation, including circulation and respiration.

Not far a rapid double check, as now almost immediately prior to space flight has emphasized Dr Raff who gave several examples of varying resistance to stress. In one instance, a pilot showed a marked decline in performance when subjected to insufficient oxygen after recovery from a prolonged absence although his regular medical examinations had failed to indicate any measurable deviation from the norm. Six weeks later, the pilot's resistance had returned to its pre-flight level.

In another, a test subject given



#### Centaur Liquid Hydrogen Engine Delivered

First LR 115 liquid hydrogen engine has been shipped to Convair Astronautics for test and integration with Convair-based vehicle stage. Convair is developing the NASA Centaur will use two LR 1150 ft-lb-thrust engines produced Pratt & Whitney LR 115.



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**Model Shows Dyna-Soar on Modified Titan Booster**

Model of Dyna-Soar aircraft-type vehicle mounted on modified Titan booster is at left; drawing at right is artist's conception of launching. Lt. Gen. Roger G. Wilson, USAF, deputy chief of staff—development, is at left in photo; George M. Stone, Boeing Dyna-Soar program manager, is at right. Photo by Bobbie Jeanne for *Aviation Week*.

Fewer oxygen after a strenuous training course, which provides 10% upper limit to long periods of endurance. He also found a very low oxygen tolerance. There shortly later, after his schedule had returned to normal, his endurance to oxygen starvation was decreased to "probably" high.

Dr. Raff is surprised. His theory points out that sections of engineers under stress are triggered by the parotid gland and the cortex of the supraorbital gland.

These sections, "which are for being educated in all their details, adapt the particular regimen to the relevant stressors—hypoxia, infections, injuries etc."

Since there was an appreciable difference in elevation and respiratory muscle strength between the sections and non-stressed sections in groups A and B, Dr. Raff concluded his experiments did not lack of oxygen as related to the respiratory system to the parotid gland and the cortex of the supraorbital gland.

Considering the different reactions of the cortex of the supraorbital gland and the parotid gland, Dr. Raff tested the two sections in groups A and B. Dr. Raff concluded his experiments did not lack of oxygen as related to the respiratory system to the parotid gland and the cortex of the supraorbital gland.



**Artist's Conception of Dyna-Soar Launch**

After retraction of the cortex of the supraorbital gland and extension of its surface, the quantity of red coloring in the blood vessels decreased and less. Dr. Raff found a substantial difference between the two groups. "He told the ICAB."

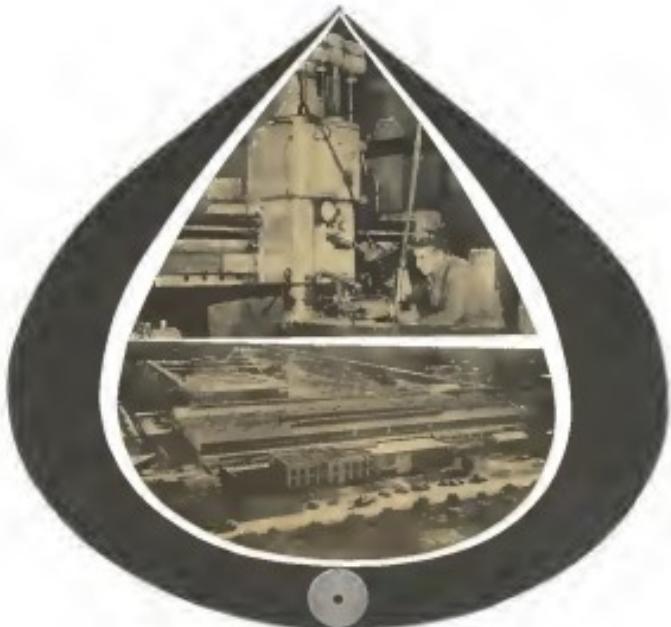
"When the decrease is compound because categories A and B also oxygen starvation, it is found that significant differences arise between those of the time of stress is constant in all these tested. The B type, i.e. more trained individuals are subject to a slight decrease of red coloring matter and have a more rapid regeneration. This may be connected with the activation of the cortex of the supraorbital gland."

"These sections, "which are for being educated in all their details, adapt the particular regimen to the relevant stressors—hypoxia, infections, injuries etc."

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For many of a hour session, Hildebrand considered two possible theories:



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turn-disk in which the vehicle approaches the earth in the same direction as the earth's rotation and retrograde, in which reverse is made in a direction opposite the earth's rotation.

### Two Trajectories

He attributed these characteristics to the two trajectories:

- Direct return flight at least launch velocity, 9,000 ft., launch angle, 90 deg.; flight time, 225 days.
- Retrograde return flight at least launch velocity, 9,000 ft., launch angle, 24 deg., flight time, 178 days.
- Direct return with smaller initial angle necessary to launch velocity, 9,000 ft., launch angle, 36.208 deg.; flight time, 36,680 ft.
- Retrograde return with smaller initial angle necessary to launch velocity, 12.2 ft./sec. initial, 46,200 ft., flight time, 36,680 ft.

Halley's comet's orbital period fitting either of one form or another probably will be needed to reduce vibrations and broaden the bounds of the return corridor, which is determined by the time available by the incidence of approach in the vicinity of the Aeronautics Bureau's heating and/or acceleration limit.

The International Congress of the International Council of the Aeronautical Sciences is scheduled to be held in Stockholm next year during the week of Sept. 10, following the 22nd Flying Days of the Society of Royal Aero Club Corporation of Edinburgh.

### Czech Centrifuge Turns at 6 Million rpm.

Washington — Czechoslovakia has built an ultracentrifuge operating which turns at 6 million rpm. and will be an important tool in basic research in particle physics.

The ultracentrifuge, which has been exhibited in Moscow according to Soviet reports, The Electron Gunette, has its central axis suspended and stabilized by an electric motor. An electric current of 100 k.c. drives the motor and it turns in a vacuum chamber with a pressure on the order of  $10^{-11}$  M. Bar.

Centrifield created on the periphery of the fast rotating rotor of this machine, which is diagonal Type UC 2 is high enough to overcome the bond strength of the strongest adhesives and galvanic coatings. It also can be used to study the structure of unstable elements, the separation of mixtures and the combination of the constituents at relatively low temperatures. The centrifuge will be used mainly for direct benefit to development work in exploring high-temperature materials for aircraft and space vehicles, fire tires and thermal fuels.

## Two Systems Aided Sputnik V Recovery

Moscow—Two separate deceleration systems were used during the recovery from orbit of the space probe Sputnik V, surface, which carried two dogs and other live specimens (AVW Aug. 29, p. 28). The first Russian-made satellite is scheduled to use these two deceleration systems along with the recoverable parachute used on Sputnik V.

Recovery and recovery sequence of the Sputnik V recoverable satellite consists of four main operations:

- Recovery of first to decelerate the satellite for safe release and bring it down to orbit.
- Recoverable engine protected in a heat shield is activated from the nonrecoverable instrument section immediately after the reentry capsule stops flying.
- Second deceleration makes them as retarded as possible due to the recoverable engine. Operation of this system has not been detailed by the Soviets. Recovery in atmosphere drag brakes could be employed. The deceleration system is used from an altitude of about 700 mi. down to about 4 mi. or around 20,000 ft. Maximum loading during the deceleration is 1.1g according to the Russians. The maximum deceleration reported is 1.6 g. The recovery capsule is expected to land at 12.5 mi. per hour.

• Capsule containing the living organisms of Sputnik V was ejected from the recoverable cabin between 20,000 and 25,000 ft. and both sections were recovered intact to the ground by parachutes. The descent rate of the cabin is specified at 32 ft./sec. and that of the reentry capsule is reported to be at the neighborhood of 25 ft./sec. Parachute decent rate called for on the U.S. Project Mercury capsule is 40 ft.

The last portion of the Sputnik V recovery sequence may actually include the design as a recovery system to be used in the event of an emergency capsule release before impact. Whether the reentry capsule would not be freed from the cabin.

Two major advantages are apparent in the procedure of designing a recoverable satellite in two main pieces. First, the weight of the heat shield necessary to protect the cabin during reentry is reduced considerably by decreasing the weight of the instrumentation and power supply before reentry begins. Second, the size and weight of the heat shield and insulation and the recovery parachute is substantially reduced because a major portion of the total heat shield weight is discarded before this is completed.

During the reentry, the attitude of the Sputnik V recoverable cabin was controlled by a system of gas nozzles activated by a distribution system.

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# Kodak and the eye

In the course of maintaining ourselves as the world's best-equipped organization in everything related to public relations, we have gone down some interesting byways.

One of these paths, some years ago, led to the production of surfaces of audience bottoms like this:



They're very simple optical devices that turn a light ray back on itself regardless of the direction it comes from. You once saw them everywhere framing the letters on highway markers. Though very cheap, their optical quality was amazingly high. (Too high, in fact. They tended to return the rays back to the headlights themselves than to where the drivers' eyes were. We found that.) After a few years of vast success in this market, we were lured out of it by a better idea—microscopic headlamps that did the same thing while dispersed in a



medium that could be applied like paint. That's what is seen on the highways today.

The world moves on. We are back on the subject of sending light to the eye, but with a sophistication far beyond that required for night-bright signs or unlit audience displays.

This comes about from our involvement in problems of picking up visual information from places where a human eye cannot or should not go. In such problems, it is not worth calling upon us if plain cloud optics TV cameras will do. We step in when it becomes desirable to broaden the talents of the simple TV camera tube with precision optical devices and with precision enhanced devices to manipulate the optical devices. As it happens, the first TV beam splitter was Kodak's and so it will be first TV enough that any well-organized brain can gather on a boarder to an honorable place in the military sections where they show the house-mounted bright-in-dark areas.

The inventions required were made by Kodak at its own expense and then further elaborated by Kodak to create this television eyeball on the shoulders of North America's A-3 Vigilante® Attack Bomber by which the occupants look around at their external environment.



For television eyeballs must eventually feed into human eyeballs. There is more to be done than putting

the image on the face of a cathode-ray tube. Space is of a premium. Small tube faces need optical magnification. Magnification loses light.

Kodak has found a way to direct the precious light onto the eyes of the watchers and not waste it elsewhere. Brightness is several hundredfold impressed over the creation while the light is simply thrown out from the projector lenses into the room in hope that somewhere a pair of eyes will catch some of it. The smaller the space from which the eyes may watch, the more the gain is lost.

Below is a demonstration, by the engineers who worked it out, of a screen material which can give the ideal reflection characteristics wanted in any given projection situation. It permits the shape and size of the audience space to be exactly specified in relation to the location of the projector. It permits several audience spaces simultaneously, from several different projectors, each audience seeing a different image on the single screen. Nobody's image is washed out by ambient light or somebody else's image. The entire viewing situation is presided by the magnification of the projection lenses and



AMMUNITION	For a bullet that rapidly penetrates our
OFFICE	work in
POWERPLANT	co-ordinating these fields,
MACHINERY	with the
MATERIALS	Government Contracts Department



Shell we meet and talk of the relation between our capabilities and your needs?

EASTMAN KODAK COMPANY, Apparatus and Optical Division, Rochester 4, N.Y.

its curvature. Very nice to have as a busy, cramped operations office whether on the ground or riding through free space or hydrospace.

You don't have to search for people who can put together such a system and make it work. They are available at Kodak; nor, a potent force as being for significant accomplishment in the sparsely settled country between optics and electronic engineering.



First stage of Scout vehicle is prepared for erection on mobile launcher mount at Cape Canaveral, Fla. The stage is lowered and rotated by a hoist instead of a grapple. Photo at bottom right on opposite page shows profile of the first USAF Blue Scout Jr. research and development vehicle. This vehicle used launch technique (AW Sept. 25, p. 29).



## USAF's Blue Scout Jr. Tested Launching



Blue Scout Jr. second stage is a Hercules ARD N251-AJ solid rocket motor. Hydrogen peroxide rocket motor propellant, will fill payload. Blue Scout Jr. was first vehicle to be used in the Hypo Environmental Test System (HETS) 60% program. A III-15 60% vehicle is intended to carry a 100-lb. Dyno-Bar model at 300/300 ft. altitude and speed of 12,300 fpm over spring.



Blue Scout Jr. research rocket is set ready to launching position with 7-10 sec. later view outside of fairing and propellant vehicle.

## Techniques



Small igniter rockets on the first stage (above) are used on launch in solid rocket. Unsigned Blue Scout Jr. is launched at 70-degree angle rocket officer stands to be launched vertically.



**BENDIX**  
**G-20**



## WITH ORGANIZATION CHART DESIGN



MEANS PRACTICAL EXPANDABILITY IN



## BALANCE WITH APPLICATION GROWTH



Just as the organization chart of any enterprise provides the framework for dynamic growth and adaptation, so "organization chart" design provides the framework for unparalleled expandability in the Bendix G-20 data processing system. This means that your G-20 can economically match, step by step, your expanding scientific or business computational workload ... without changing system nature. • Key to the organization chart efficiency of the Bendix G-20 is the ability of the Central Processor to "delegate" routine data handling tasks to central buffers, acting as "line supervisors." Thus freed, the Central Processor can make most efficient use of its high computation speed, its ability to schedule program priorities and

direct accessory equipment assignments. • The ability to employ many control buffers gives new meaning to expandability in the Bendix G-20. Up to 79 input/output units can be directed by each of these "line supervisors." The Bendix G-20 has a complete line of accessory equipment including keyboard, paper tape, punched cards, high speed line printers, and 2 million word magnetic tape units. • Memory represents another dimension of G-20 expandability, ranging from 4,096 to 32,768 words. • Investigate the organization chart design of the Bendix G-20. See how it provides balanced, practical expandability — at a cost that assures unequalled data processing performance per dollar invested. • For detailed literature write:

Bendix Computer Division  
DEPT. AP-101, LOS ANGELES, CALIF.



## Mercury Landing System Tests Completed

Washington—Rudolphine has completed qualification of the Project Mercury capsule landing and recovery system at National Aeronautics and Space Administration's Langley Research Center under a revised flight test program.

Tight Mercury development schedules require subcontractors to be developed and proven simultaneously with the development and early flight testing of the capsule (AW, Sept. 20, 1962). Therefore, the first integrated capsule will be ready for the first maneuver before flight within the next four months. Balance flight tests of the capsule's reaction control system with Redstone and Atlas boosters are scheduled before the first nominal flight.

### Test Program

Mercury landing system was developed and tested during its 35 month program conducted by Rudolphine Division of the Northrop Corp. under subcontract to McDonnell Aircraft Corporation. It has been accepted by McDonnell and NASA.

Two-stage Mercury landing package uses improvements of existing equipment. The 16-month Rudolphine effort has been cut by 10 percent. Landing system scale model development, development and test were accomplished with only one failure in 55 aircraft drops using full-scale engineering models of the capsule (AW, Feb. 14, p. 32).

Seven reliability checks Rudolphine sets at higher than 99.7%, also have been demonstrated by its use in 22 flights by NASA in all the pad abort, Little Joe Big Joe and Atlas tests of engineering and production capsules.

### Single Test Failure

Single failure in the Rudolphine program occurred in the 41st drop in a test of the effectiveness of the rescue procedure. The test objectives, including one initiation of deployment and when the rescue chute deployed, the return nose was clutched by a sharp surface on the return census. The capsule would fall 6,700 ft., break apart on impact.

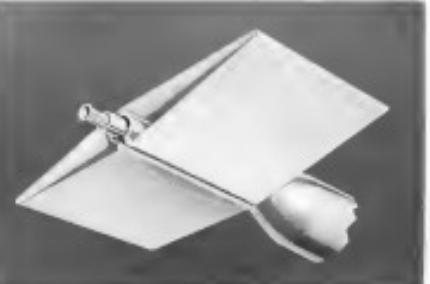
In a total of 101 flights on production capsules were sound or blamed to discover potential hazards of sharp edges.

Mercury landing package consists of a single parachute, waist and rescue riser, chute, aerosol and aerosol access explosive attachment and recovery rod. Normal landing sequence begins at 42,000 ft., following capsule reentry from orbit. The aerosol inflation occurs when the altitude reaches an elec-

trical circuit to ignite a motor shell carrying the 6 ft. rubber drogue parachute. The drogue chute, first stage in the sequence, soon deploys to stabilize the capsule and slow it from Mach 1 down to a true impact of 16 ft. M.

The drogue chute, which is inflated by a burst of oxidizer from the 6 ft. Recovery system, is then ejected from the capsule to the descent canopy. Opening shock of the 6 ft. Recovery system punctures a secondary, delayed deployment. The Recovery chute is then partially inflated for 4 sec. before it inflates fully.

The main chute slows the capsule to



### Rocketdyne Develops Space Heat Radiator

Moving hot heat radiator for satellites, shown in the center inset, is under development by Rocketdyne Division of North American Aviation, Inc. Designers say it will operate even if pressurized by meteoroids, because hot liquid could penetrate to the outer bullet. Built around fins with heat rejection core and move continuously to dissipate heat. Speed can be preset to maintain constant temperature.





## Nuclear claws for a new breed



## of Falcons

The Hughes Falcon GAR-II is the first air-to-air guided missile to pack a nuclear punch.

Developed by Hughes, the "Nuclear Falcon" adds a major new weapon capability to our defense arsenal. A weapon that can down any bomber in the skies.

Because of its heavy blast intensity and high degree of accuracy, the "Nuclear Falcon" is particularly effective in high-speed closures against bombers carrying the deadliest of weapons.

The Falcon family has proven itself in operational service—every modern U.S. all-weather interceptor carries Falcon missiles. In simulated tactical flights Falcons have achieved unexcelled records for accuracy and reliability.

Like other Hughes weapons, systems and components, the Falcon is a product of Hughes' unique capabilities in virtually every area of advanced electronics. These include projects in space systems, airborne control systems, microwave communications, data processing and display systems, ASW systems, radar and IR detection systems—and many others.

These advancements in the style of the electronic art are based on foresight, imagination, and proven management capability. Their reliability and operational capabilities have earned them the confidence of users throughout the free world.



Larger than earlier Falcons, yet overall considerably lighter, the GAR-II is 11.7 feet long, 17 inches in diameter and weighs slightly over 200 pounds.

Credit: A. van Vliet and J. P. Lefebvre

**HUGHES**

HUGHES AIRCRAFT COMPANY  
General Electronics Company  
Electronics Division, General Dynamics  
St. Louis, Missouri • Indianapolis, Indiana • Atlanta

## Army Describes Communications Satellite

By Philip J. Kline



### Bulova run-away escapements

Bulova's history of the manufacture of time keeps practical solutions to some of the greatest challenges in defense and industry. One case in point is the Bulova run-away escapement, a simple, rugged and relatively inexpensive device for measuring short periods of time. Constantly used in scientific and velocity indicators, these mechanisms have wide-spread application yet to be explored.

The artist's conception above depicts a run-away escapement device for measuring the speed of a mass system driven by a magnetism. The torque measured through the gear train rotates the escape wheel while, at first, oscillates the pallet. The starting and stopping of the pallet as it oscillates acts as an inertia break

$$T_0 = L \frac{d\theta}{dt^2}$$

The initial conditions at  $t=0$  are  $\theta=0$  and  $d\theta/dt=0$ . Integrating Eq. (1) twice and applying the initial conditions results in

$$\theta = \frac{(2L\omega_0)}{T_0^2} t^2$$

where  $\theta$  is and  $\omega_0$  is the half-cycle amplitude and  $T_0$  is the period respectively, and the total pallet displacement is  $\theta + \theta_{0.5\pi}$ .

In this example, the escapement controls the action of a cam-follower mechanism. The same principle can be adapted to many other applications

such as a timer for closing an electric circuit, a velocity indicating device used in computers for integrating acceleration functions.

Bulova's skills come from those associated with the continual problems in developing, designing and producing timing mechanisms which fully meet the stringent specifications of the military and industry.

The artist's conception above depicts a run-away escapement device for measuring the speed of a mass system driven by a magnetism. The torque measured through the gear train rotates the escape wheel while, at first, oscillates the pallet. The starting and stopping of the pallet as it oscillates acts as an inertia break



Bulova Research & Development Laboratories, Inc.  
1214 Westchester Avenue, White Plains, NY 10603

both military and commercial.

Executive consolidation data states that ground station will be located near major communications centers so that they will have maximum capabilities at the conclusion of research, development and engineering evaluation," he added.

The ground station which Bulova suggests for the first phase would employ facilities which are almost identical to those in the two ground stations which Army has established at Fort Monmouth, N.J., and in Puerto Rico, as well as its Project Control Center, located at Kwajalein Atoll (AWW Aug. 29, p. 22). Details are:

- Antennas diameter: 28 ft
- Power output: 1 kw
- Bandwidth: 1 arc per channel
- Receiver noise temperature: 100K
- Cut-off noise radius: 22 db

### Satellite Characteristics

Communication satellite designed for initial phase of various investigations would weigh about 1,000 lb., of which 750lb. would represent communications equipment, receivers and tracking hardware. Shelf and structure are estimated at 200 lb. power supply at 250 lb. and attitude stationkeeping control system at 200 lb. with remaining 75 lb. unassigned to a solar cell.

These are the operating characteristics of the initial phase communication satellite.

They are the operating characteristics of the initial phase communication satellite.

- Number of channels: 10
- Bandwidth: 1 arc per channel
- Frequency range: 1,700 to 2,400 mc

### Advent Subcontractors

Bulova Corp.'s Systems Division and General Dynamics' Marine and Space Vehicle Dept. are the two major subcontractors on the Project Advent Communication satellite intended for preliminary experimental orbit. Bulova will develop the communications payload, a closing receiver, transmitter command and control equipment while GDS will develop satellite vehicle shelf and its electron power supply. Other programs under the direction of Army Signal Corps' Honolulu command is with the Army, while GDS is with the Air Force's Defense Missile Division, which is responsible for the launch vehicle initially under joint venture.

Satellite will use an infrared or search-and-rescue antenna with a diameter of about 3 ft., giving a beamwidth of about 25 deg. This infrared narrow beam will provide increased communications and thus privacy, for military communications. However, it will also provide greater sensitivity of surface areas and positions, such as within 100-mile diameter.

The advanced communications satellite will require continuous power supply of about 1,000 watts. Thus, the power needs of the radio transmis-

(Continued from Project Counter I)

- Power output: 1 kw per channel
- Antennas: 25 db
- Antennas diameter: 30 in.
- Primary power: 100 watts

To provide minimum reliability, the initial phase would consist of one multiple narrow band channel of size 10 arc, utilizing at 30 different radio frequencies. Future of one channel will use one-half of a number of satellite capacity. Transmitter output reflector will be made which will be operated with sharp elliptical orbits to provide long life.

At selected operating frequencies, the 25 db channels antenna would produce a beam approximately 25 deg. with a 30 db peak gain, or about one-third of the earth coverage of the polar arcs. Antennas will be fixed to satellite shelf and will depend upon satellite attitude control to keep it aimed at the earth. It will be an elliptical orbit, 10 within an estimated six degrees. Station-keeping controls would be designed to keep satellite in its desired latitude longitude within two degrees.

### Advanced Version

The next advanced communications satellite is expected to weigh about 3,000 lb. of which 1,000 lb. is allocated for the communications equipment. The larger payload will provide increased bandwidth, 3,000 mc, and increased resolution with 10 arc for the earth coverage. To obtain increased resolution, the operating frequency is expected to move up to the 4,400 to 5,000 mc region.

By using traveling wave tubes in the utilized in gas ion output power of few watts per channel, no additional 100 arc band channel will be required. Each will be capable of supplying 1,000 transmitter or incremented one-channel plus one television channel. Wherever appropriate, the satellite will use an infrared or search-and-rescue antenna with a diameter of about 25 deg. This infrared narrow beam will provide increased communications and thus privacy, for military communications. However, it will also provide greater sensitivity of surface areas and positions, such as within 100-mile diameter.

The advanced communications satellite will require continuous power supply of about 1,000 watts. Thus, the power needs of the radio transmis-





## WEAPON SYSTEMS BY REPUBLIC'S MISSILE SYSTEMS DIVISION

Bridging the scientific and technical gap between military necessity and tested, proved, reliable weapon systems is the task of Republic's Missile Systems Division. Our scientists and engineers plan, direct, and supervise projects from conception to operational hardware...through systems synthesis and analysis, research and development, prototype fabrication, test, and production. Here, Republic designs and builds completely integrated systems for performing vital defense functions.

Present programs include work in:

- + Air/Space Vehicles
- + Guidance and Control Systems
- + Infrared, Radar and Photographic Sensors
- + Data Processing and Display Equipment
- + Ground Support Equipment
- + Secure Communications Links
- + Nuclear Weapons Phenomenology



standard subassemblies can be built without paying too great a penalty for miniaturization. Each subassembly in the DENSE concept represents some basic function at a portion of one, such as a flip flop, and/or some logic, logic module, code converter, etc. The subassembly would have optimized dimensions of 1.1 in. in length, 1 in. in width. It is in modules and could accommodate a maximum of 25 standard memory components or gate packages (five would provide component densities in excess of 100,000 components/inch<sup>2</sup>, which is 10 times more than present). Components are dropped onto dual substrate interconnect structures with a brush with a Heisebond tip and are then worked to take up each slot.

The step-by-step DENSE construction approach is as follows: standard wave patterns for interconnection of components in basic subassembly circuits are repetitively blended out of a long, narrow (by contrast to 1 in. width) flexible ribbon. It is soft like. As the pattern is being stamped, tabs on the ribbon to which components will later be welded are turned up normal to the surface of the ribbon. The resulting pattern on the ribbon is a kind of dot matrix pattern with the internal resistive portions being the conductive connecting paths between elements. This stressed wiring dot pattern has an outside connecting edge to prevent it from cracking during bending.

### Copper Ribbon

The ribbon is made of bare copper, a compromise of a good soft metal and one which can still take solder. It is light weight and its plastic base will be cheap.

After a glass covering is plated over the entire pattern of the ribbon and exposed to it to hold the pattern together, the remaining glass is then removed. The individual components are then welded or joined together or two center tabs which are melted onto both pieces.

Then the basic subassembly structure—namely, two stamped wiring boards held facing one another and separated by two center studs less than .5 in. in height. Components can then be placed around the periphery of the module with their axial leads turned against studs on the wiring boards. Terminals are not glued back-to-back as they are surface-to-surface approaches but are supported by the strength of their own leads. A maximum of five components can be placed along either length of the module, five on the ends. Component leads can then be welded to their respective tabs. All components are mounted on a 1/10 in. grid pattern.

Because the subassemblies are structurally sound, flattened tips, encapsulated

Great names—that made  
scientific filtration possible



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Robert Boyle (1619-1691)

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Globe or Air Filters — from simple to private aircraft there is an Air-Maze filter to meet your requirements.

In-Line Filters — one 1/2, eight-weight. These filters are used to protect hydraulic fuel systems.



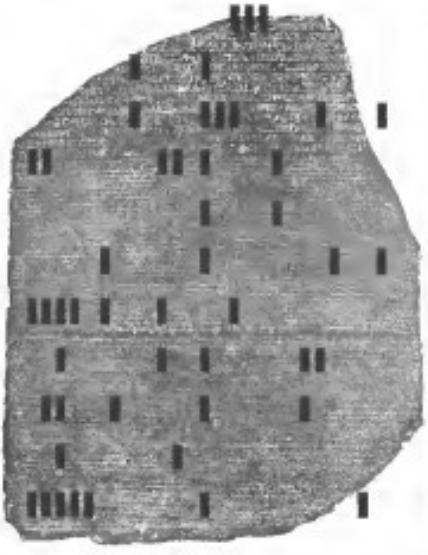
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The Rosetta Stone answered secrets that had been buried for centuries. It bridged the gap between known civilization and unknown, ancient Egypt. The discovery of the Stone was an accident, one of those various events that sometimes happen. Modern science faces a language problem much more complex than deciphering hieroglyphics. And once again a Rosetta Stone is needed. But science cannot wait for an accidental discovery. Each branch of science has its own language which it uses to state problems. Not electronic computers can solve problems only if they are posed in the language of the specific computer. Translating science languages into computer languages is extremely costly in time and money. UNCOL (Universal Computer Oriented Language) is a possible solution. The development of UNCOL will bridge the gap between a multitude of Problem Oriented Languages and an increasing number of Computer Languages. UNCOL is an link which connects constituents at System Development Corporation.



tion of the carrier assembly is not necessary and components can be soldered in as required. Hard components in a housing assembly can be located secured because they are on the outside of the substrate and soldered. The substrate components can be soldered either than welded into the assembly so that location of a replaced component can be noted from the soldering point.

#### Component Failure

When a component fails in other soldering applications, it is frequently provide structural strength of the pack, the phenolic will be destroyed for entire with. At least the package component will crack and split components. Use of the three way packages is a matter of logistics for a particular application. Costs of three way units at times become staggering. For example, an engine test Supco Corp. a piston in this field, has stated that cost of these parts by his vendor will add up to \$1,100 each in production.

Forrest indicates however that it is not certain that welded parts without encapsulation will prove sufficiently reliable for automotive use. Since they fail to be a more compact and structure when used, replacement methodology would have to be developed.

To overcome herculean solder jobs are soldered in a similar board fashion onto a gull-winged circuit board on such a manner that components so do not solder and are normal to the etched boards. This forms a half module and interconnections are made among substrates on the etched board and the substrates are joined with polyimide for insulation. Two half modules which are homogeneous to each other can then be soldered together to form a module approximately 3 mm thick. The two half modules can be held together through the lead in the substrates and spaced placed atop from. The result is an extremely light, but mechanically strong unit.

#### Standard Connectors

The modules are standard printed circuit board connectors. Each module occupies 1/2 of two connectors at no sacrifice in space. Formed wires, and gives a module with modular outside surfaces, thus protecting the connector from shorting.

At the time of this work, Forrest says a flip flop has been made and tests satisfactorily. In addition, a complete computer using this approach and measuring 4 x 5 m on a 1 m center has been laid out.

Read availability of and testing individual substrates is a relatively simple procedure. Forrest feels any manufacturer can be supplied with a sample



#### Transmitter-Receiver

Volmerough hopes to offer transmitters, for long-range ground communication, cover frequency band of 2 to 13 mc. Teardown weight 56 lb. including remote control selector. Transmitter output at 51 watts. Operation is from 14 to 28 vdc. Model number NTH-1. Manufacturer: Northern Radio Co., Seattle, Wash.

substrate, placed next to unplied substrate. Then a maximum of four components can be inserted in respective slots as indicated by the circuit. Wires can be easily inserted and leads wells spliced more quickly than today's solder joints. Only one heat shrink tube is required to terminate.

To date, one company has obtained and exchange information on soldered packages technique. A member of company aware as added packaging have reported an informal conference which has held since meeting during the past year at the First Annual Booth Areas in Garden City, N. Y., the second of Supco Corp. in Allentown, Penn. and most recently, the third meeting at the April Annual Meeting in Denver.

Participating in the committee are the following companies: AC Spark Plug, Aerostar, Allis-Chalmers, American Locomotive, Almaden Research, Avco, Boeing, Aerospace Division, Electronic Research Co., Foster Electric, Electro-Mechanical Components, General Electric, Hughes International, Reliance, National Research Council, Lockheed, Martin, MIT Instrumentation Lab, Remington Rand, Union Carbide, Space Technology, Latin Spain, Gruas, Sistec, Walter Y. Stirling, Johnson Electric, and Wurzburg. In addition, Diamond Ordnance Fuzes, Laboratories, Inc., part of a consortium of the U. S. Space Project Office and the Air Force Ballistic Missile Division.

A major problem evaluating growth of the soldered packaging approach is the quality of components which lead to, but slightly better than, cables made of standard stainless steel.

**GOOD THERMAL CHARACTERISTICS.** The thermal expansion characteristics of new "no-mag" cable are much closer than those of standard stainless steel or carbon steel cables.

Get the complete story on this new technical development for the aircraft industry. Write today to Forrest office.

## NEW "NO-MAG"

### NON-MAGNETIC AIRCRAFT CABLES

- GOOD THERMAL CHARACTERISTICS
- CORROSION RESISTANT
- HIGH FATIGUE RESISTANCE
- HIGH ABRASION RESISTANCE
- PRESTRANDED CONSTRUCTION



### Eliminates Instrument Interference!

As datum we expected, many manufacturers were interested in our new non-magnetic aircraft cable. If you did not see it, "no-mag" has these characteristics:

#### NON-MAGNETIC PROPERTIES

"no-mag" cable is made from type 303 stainless steel. It retains non-magnetic ability under severe cold working—in contrast to standard stainless steel cable which shows a pronounced increase in magnetic susceptibility, when drawing or stretching operations.

The non-magnetic properties of "no-mag" cable eliminate instrumental interference from cable magnetism.

#### CORROSION RESISTANCE

New "no-mag" cables have environmental qualities similar to, but slightly better than, cables made of standard stainless steel.

#### GOOD THERMAL CHARACTERISTICS

The thermal expansion characteristics of new "no-mag" cable are much closer than those of standard stainless steel or carbon steel cables.

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### Automotive and Aircraft Division AMERICAN CHAIN & CABLE

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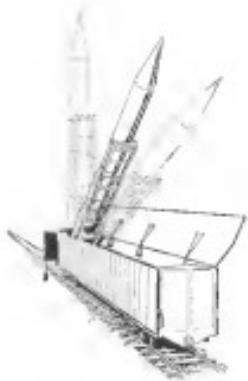
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*Landing speed of the McDonnell F4H reduced 8%  
by Solar built boundary layer control system*

BOUNDARY LAYER CONTROL—achieved by bleeding air from the propeller engine and directing it at nose spuds over wing control surfaces—reduces by 10 knots the landing speed of McDonnell's F4H fighter.

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call on Solar's proven capabilities in the field. Write today to Dept. H-106, Solar Aircraft Company, San Diego 12, California.



parts which are suitable for welded assembly. While most lead materials can be welded, Federal says the two lead and copper parts that will be lost in a series connection had to decide just how to split each component weight after the value of welded packaging.

Aldehydes (solvent per cental) would be a fast lead removal technique in welded packages. Anyways one is deleted, at least should be made of the pure material.

## Instrument May Speed Missile Tracking Data

SORITI (the automated real-time tracking instrument) was under study by the Air Force, apparently as a means to provide accurate measurements and real time tracking data for analysis and possible flight correction.

Radiation Inc., McLean, Va., will develop the design of the tracking station under a \$1.1-million task contract. SORITI ultimate aim is to provide for orientation reference, synchro to correlate the motion of ballistic missile tracking with the instrumentation realized at real-time intervals. Design of sensor of the system is still several years off at 20 percent completion now.

The basic SORITI concept calls for an alternative optical mechanical system to the feed plane of a ballistic missile system in a manner similar to that of a photo-tube detector system. A rotating mirror reflects changes in status of the sun in the X and Y planes. A closed loop to the mirror system controls movement of angular measurement and its output is generated by the detector tube to pro-

vide an accurate reading of the angle displacement between the optical axis of the sensor and the sun. It is known that the inner angular position of the star at any instant of time will be measured in an IBM 360/65 computer. The SORITI system is intended to provide accurate, timely location with a contamination of errors caused by atmospheric refraction and atmospheric enlargement.

## 1970 FILTER CENTER

### Instrument Component Reliability

Background—Autonics is seeking various subcontractors to provide instruments to check for filters being supplied to its Minuteman guidance and control system reliability program (AW Oct. 19, 1970, p. 49). In General Precision, Microelec, Fairchild, Tronox and Delco. Additional regular source contract is more stringent manufacturing and reliability control as at present. Minuteman component subcontractors history for濶ade sources is being considered.

### Filter Reliability Increases—Hoffman

Hoffman reports that defense Department is interested in the Hoffman model 130 filter system for the National Electronics Measurement Board (NEMB) which adheres to the Agency's AGREE test program. The Hoffman AGREE test becomes the first complete equipment to handle the tough AGREE test under which source model. Test equipment showed only 1.7% failure failure. The filter system equipment is expected to exhibit only slightly longer MRR (AW June 17, p. 57).

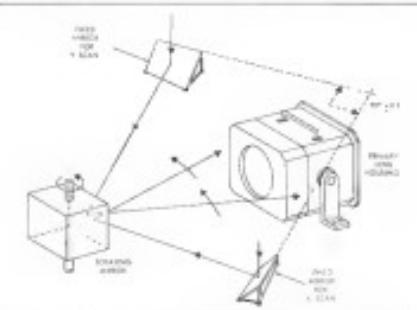
► **Res. Area R&D Equipment—See Transformer** Res. area continues to be an active interest for customers and space technology companies. Arthur D. Little, Inc., Cambridge, Mass., research organization active in several space programs is now shipping its lead for a research facility on the West Coast. Until now Little's only representation on the West Coast was provided by consulting offices. One of the newest units on the peninsula is the recently organized U.S. Systems Development Laboratory, in Palo Alto, formed by a small group of technical specialists previously with Delco in Palo Alto.

► **Transformer Sales Trend Continues** Transformer sales for July were 7.1 million, up 10.6% over a year ago. July 1970 was the same month of 1970 compared with a 12.0% increase in transformer sales to July 1969 over same month in 1968, according to Electrical Indicators. Auto figures just released. Dollar sales in July this year were \$8.8 billion, 12.5% higher than the previous year. By way of comparison, sales in July 1970 were 28.0% higher than in July 1968. Latest figures confirm semiconductor market saturation based first quoted by American Wire when April sales figures were released (AW June 1, p. 51).

► **Film Antenna Breakdown Study Set** First of three NASA Capra solar flights will carry uninstrumented studies conducted by Stanford Research Institute is scheduled for flight at the Eglin Gulf Test Range (AW Sept. 18, p. 61) in late October. In addition to epoxy wave, the propagation study, the rocket will carry six-powder X band and UHF transponders in an effort to study antenna breakdown in upper atmosphere.

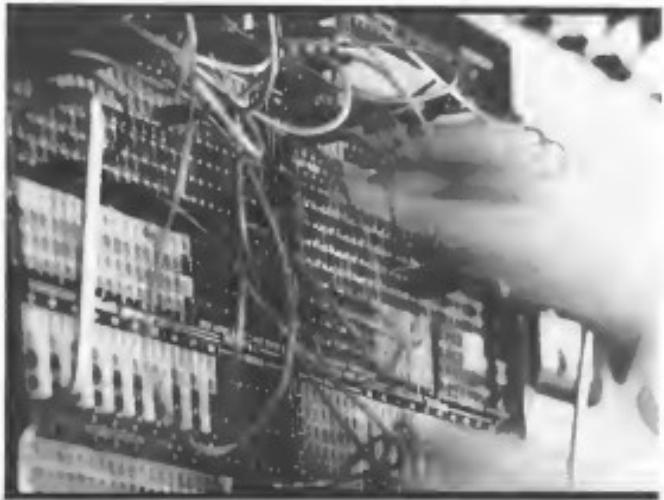
► **Infrared Filter Range Extended** Infrared wavelength filters with sharp cut off that can be placed anywhere between 14 and 80 microns and even filters for wavelengths up to 16 microns or beyond. The last development is from Inc. Belfenart, Calif. Company says that filters pass at least 60% of the radiation in their position but less than 10% in their rejection band. The filters make it possible to detect and discriminate between objects having very small temperature differentials over the temperature range of -160°C to 110°C.

► **New Photo-emissive Material Developed** Photo-emissive material, for imaging and photoluminescent panels, which maintains a high sensitivity for many hours at operating temperatures of 230°C during the top temperature layer in which solar cells can be operated, has been developed by Wurting



**PRESINT** concept for SORITI instrument under development by Radiation, Inc. is shown schematically. Method permits accurate angle location with immersion error caused by atmospheric refraction, atmospheric enlargement, etc.

# DYSTAC\*



## A MAJOR BREAKTHROUGH IN PROBLEM SOLVING

**DYSTAC**: Dynamic Systems Analysis Computer, developed by CSM, incorporates high-speed computer resources with unique software designed to solve complex problems. It can handle more than 100 million calculations per second, with a data base exceeding 10,000 microsecond. This system has been widely used in the analysis, synthesis, and design of solutions associated with analog computers, and several solutions associated with analog computers.

**DXTRAC**: Dynamic Systems Test Computer, developed by CSM, provides unique data storage at computer speeds and high speed measurements. These features make possible the rapid analysis of test data. This technique can be applied to the analysis of data from physical phenomena, and to the development of new computer components or new test techniques. Different combinations of these two development tools yield profit in their direct application.

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isone Electric. The material, consisting of silicon, potassium and strontium, has been applied as a semi-transparent surface on a glass substrate and has exhibited photo-response values up to 80 microamps per square. Material was developed under Navy Bureau of Ships sponsorship.

► **Handy Chart** On Computer Chart acknowledge-Electronic control computer has a projected circumference of about 47 linear centimeters. At the center is a liquid crystal display. The chart is generated by Adtran Associates data processing equipment now selling for \$150,000-\$180,000. The model Monarch XI. Chart includes such drift in print, storage capacity, word size, instruction address, cell size, access time, plus data on variable external storage, input and output devices. The computer copes to supplement this chart periodically. Copies of the computer characteristics chart can be obtained by writing to Adtran Assoc. Inc., 142 The Coast Bend, Bedford, Mass.

► **Defense Electronics Growth Slows Up**-Growth of military electronics market, which has risen an average of about 20% every year since the end of the Korean War, is likely to begin to level off in an estimated 7% growth for next five to 10 years, according to Electronic Industries Assn. Problems are based on surveys of more than 30 members of EIA's Military Marketing Data Committee. The group estimates defense electronics spending this year at about \$5 billion. Supplementing that will be another \$150 million in electronic hardware expenditures in Federal Aviation Agency and an estimated \$300 million of the National Aeronautics and Space Administration's 2015 million total budget, Electronic Industries says.

► **Call for Papers**-Call for prospective papers for the following technical conferences has been issued:

- Winter Convention on Military Electronics, Feb. 1-11, Los Angeles. "State of the Union" (classified) sessions will be included. Send 180-word abstracts and 500-word summaries to: Dr. James E. Myers, Hoffman Electronics Corp., 3717 South Grand Ave., Los Angeles 7, Calif.

- Fifth Midwest Symposium on Circuit Theory, May 7-8, University of Illinois, Urbana, Ill., devoted exclusively to network topologies and graph theory, reducing active and passive networks, infinite element networks and matching networks. Send copy to: Dr. George T. Lee, Dept. of Electrical Engineering, University of Illinois, Urbana, Ill.

AVIATION WEEK, October 12, 1969

**BALANCED WAVE TIG  
WELDER DELIVERS DEEP,  
CLEAN "X-RAY" WELDS  
ON SHEET METAL or PLATE**



\* A bold new concept in electrical design and circuitry is introduced in the all-new Miller BW-3000AP. One of several notable results is complete and automatic elimination of the dc component of all welding currents... an essential in certain types of welding applications.

\* Due to the specially designed transformer, high arc utilization voltage and unique circuit, no energy control is required.

\* "Balanced" voltage reduces the high arc initiation voltage to a low open circuit voltage - even in case of malfunction of the rectifier.

\* True independent welding voltage with overlap offer an infinite number of position, fine current settings - another characteristic of Miller's electrical control that speeds up and simplifies control welding jobs.

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- 2. Arc stability WITHOUT HIGH FREQUENCY at or less than 18 amperes

The multi-function versatility of this welder, and the specifics on its various features, are detailed fully on our form #BW-3 — a copy of which will be sent to you promptly upon request.



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## Kinetics 100-pole, double-throw, 15-amp switch occupies only 45 cu. in.



The compact, domed-style motor driver is mounted in the new Kinetics 15 amp double-throw, 15-volt switch. It runs off 15-volt battery power and provides rapid switching between two resistive conditions.

In space draft and missile applications, Kinetics Corporation has developed a new switch that combines maximum reliability with occupying both firmly and compactly the most circuitry in the least space. The new 100-pole, double throw patch panel uses only 5.1" x 3.7" x 3.0". Each switch contact can carry 15 amperes at 15-volt switching approximately 5 times.

The Kinetics switch is motor-driven for maximum reliability. There are no permanent magnets or springs, no heating devices, no valves, using the power of air to move contacts. The contacts can be transferred to 40 G's, 1000 cycles. Once it's transferred, no power is required to hold it in position, saving batteries. The switch works on instant start-up contact closure, and can withstand 1000 to 2000 cycles, 40 G's. Voltage drop across contacts is less than 10 millivolts at 15 amps.

**KINETICS**  
CORPORATION  
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## NEW AVIONIC PRODUCTS

- Inductors for printed circuit board use, now available in 26 models with wire leads, have outside diameter of 0.46 in., temperature coefficient of less than +30 ppm/C. Range of inductance is 0.05 to 2 microhenrys with



"Q" values ranging from 120 to 250. Operating temperature range is -50°C to 125°C. Inductors are suitable for operating at frequencies from 10 to 250 mc. Microtacor, Corning Electronic Components, Depauw, Corning, N.Y. Works, Corning, N.Y.

- Digital display, Series 80-000, can display any combination of up to 12 words with choice of four colors, black, green, red, orange, yellow, green or blue.



### Selection of appropriate lenses is

eliminated with corresponding wide-angle optics. These measure up to 1.5" in diameter and are lighter than 1 lb. Manufactured by Industrial Electronic Engineers, Inc., 5528 Vineyard Ave., North Hollywood, Calif.

- Maximum rate gyro, operating from 25 volt current 14 in. diameter and 31 in. long, weighs 3 lb. Gyro hysteresis is 0.1% maximum and accuracy is



## THE SPOTLIGHT'S ON PERFORMANCE

with CEC's newest strain gage  
pressure transducers



And the accent's on versatility! As a family, these three cover a pressure range from 0 to 10,000 psi in gage, absolute, and differential models... always provide top performance, even in applications with great extremes of environmental conditions.

Above, TYPE 4-325 is the smallest—only 6 grams—and extremely reliable where size is critical. Differential models cover the range from 1.5 to 60 psi, while absolute and vented gage units measure pressures from 10 to 2000 psi. Write for Bulletin CEC 1629-AF.

Opposite page, TYPE 4-324 has the finest inherent performance capabilities of any strain gage pressure transducer available. It's rugged—able to withstand 10 g's environmental shock and vibration, and gage pressures from 0 to 10,000 psi. Write for Bulletin CEC 4206-72.

New TYPE 4-218 has a built-in thermal heat shield, making it ideal for surface applications. Sealed gage and absolute models are available for low, medium, and high-pressure measurement. Write for Bulletin CEC 4225-JA.

Other strain gage pressure transducers in the CEC family are described in Bulletin CEC 1395-32A.

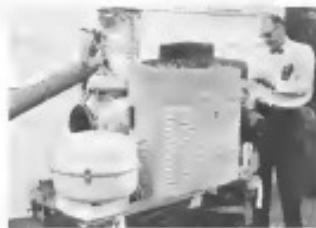
Transducer Division **CEC**

**CONSOLIDATED ELECTRODYNAMICS** / producer, distributor

A DIVISION OF **Malte-Howell** • PREMIER PRODUCTS THROUGHOUT THE WORLD

# Barber-Colman temperature controls chosen by leading makers of ground support equipment

Today's air and space vehicles call for a growing army of ground support equipment. Shown below are a few examples of support units employing Barber-Colman temperature control systems. Components and include control boxes, actuators, valves, temperature sensing elements, and thermometers. The systems are specifically engineered for each application through the teamwork of the ground cart manufacturer and Barber-Colman. For help on your ground support control projects, contact the Barber-Colman engineering sales office nearest you: Baltimore, Boston, Fort Worth, Los Angeles, Montreal, New York, Rockford, Seattle.



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INDUSTRIAL AIR HANDLING UNIT. HONEYWELL AIRCRAFT & SPACE DIVISION



## BARBER-COLMAN COMPANY

Dept. A, 1022 Rock Street, Rockford, Illinois

AIRPORT AND AIRLINE PROPULSION AIR VALVES  
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### TYPICAL FUNCTIONS BARBER-COLMAN GROUND SUPPORT CONTROL SYSTEMS

Controlling temperatures of missile guidance compartments and strakes

Controlling temperatures of missile measurement compartments

Controlling preflight cabin temperature, pressurized jetliners...and many similar pressure applications.



114, according to manufacturer. Unit is hydraulically actuated and has a service life of more than 300 hr. Manufacturer: Minneapolis-Honeywell, Inc., 2805 Cass St., San Diego 6, Calif.

• Telemetry air signal amplifier, Type 2162, for amplifying output from environmental thermometer. Gain is adjustable from 1 to 50. Response is 5 cps to 4 kc. Output is 25. Sixteen transistors are used throughout. Also available: rear of event timer, Type 2165A, in this



series noisy generator. Neural range stage is 0.01 to 100, but can be adjusted with other values. Output is 5 V. DC power requirement is 12 V. The unit is classified for ballistic missile environment. Manufacturer: Electro Developments Corp., 3934 University Way, Seattle 5, Washington.

• High-power voltage-variable amplifier, Type 2-162, has maximum CW power of 50 watts over entire frequency range of 2.9 to 3.2 kc. Similar voltage-variable magnifiers can be designed for 100 mc bandwidths, modulus in the 2 to 4 kc range, modulation 30 cps. Driver is a complete RF package, requiring only input and output power connections. Input power is about 110 w at 1000 ohms. Plate efficiency is 95% to 98%. Net weight is 11 lb. Manufacturer: General Electric Co., Power Tube Dept., Schenectady, N.Y.



• Integral printed circuit switch, called "Thru-Switch," is bolted to printed board utilizing board's conductance. As many as 20 circuits can be switched through a 1 in. diameter hole. Up to 10 switching surfaces per inch can be ganged. By stacking printed circuit boards. Manufacturer: Alfred Allgeier Co., 181 River Road, Nutley 10, N.J.



### COMMUNICATION EQUIPMENT TYPE 1930 ARMED FORCES TYPE 1938

## Headsets and other products

Communication Spacemen: Headphones and Microphones  
Explorer & Moonlight: Headsets  
Interphones: Microphones, Headphones, See Definitions  
Definitions: Microphones, Headphones, See Definitions

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# AERONAUTICAL ENGINEERING



HU-16 Alouette II (left) and the Sikorsky H-34 are two of the aircraft competing for mobile support roles at Warner AFB. The evaluation may result in purchase of a mixed fleet of up to 200 STOL fixed-wing and rotary-wing aircraft.



## USAF Evaluates Aircraft for Missile

By William S. Reed

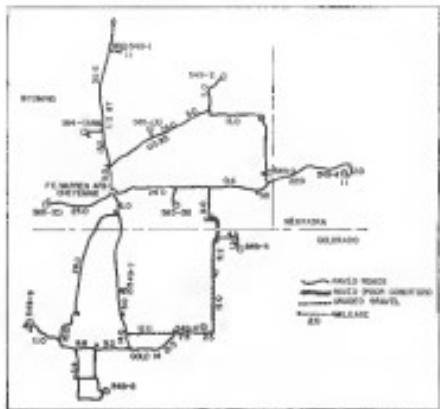
Warren AFB, Wyo.—Helicopters and light, fixed-wing aircraft manufacturers are competing for orders for mobile air support aircraft, which soon will be placed as a result of a survey currently being conducted here by the Strategic Air Command. Probable outcome of the survey will be a recommendation to purchase a mixed fleet of up to 200 STOL fixed-wing and rotary-wing vehicles.

Among the light aircraft and helicopters being evaluated are:

- + De Havilland L-39, Convair 107 Helo-Cruiser, L-28, Lockheed LASA 60
- + Sikorsky H-34, Bell HU-1, Kaman M-45B and Republic Alouette.

The transportation requirements study has been completed and finalized with the aircraft but still remains under investigation as well. In general, it shows, because of time, cost or weight of cargo, etc., airfield will not be feasible. SAC transportation officers estimate that surface vehicle travel requirements will amount to about 4 million ton-miles annually necessitating replacement of equipment every three years instead of the AF Air Force's seven for five years. Estimates as to the number of aircraft required and their daily utilization could not be made because of insufficient data.

A SAC team studying missile site support transportation requirements is headed by Lt Col R. C. McClellan,





## Navy Sub-Hunters guided by Ryan C-W doppler navigation

No weapon is more elusive than the modern submarine. For the vital task of detecting these underwater craft, the Navy equips almost every type of anti-submarine aircraft with today's most advanced proven type of inertial navigation—Ryan continuous-wave doppler systems.

The world's leader in the design and manufacture of continuous-wave doppler systems is Ryan Electronics. In production are Ryanair® doppler navigation systems which provide complete, accurate navigation information in all weather conditions, over water

or land. And, equally important, this information is supplied without the aid of ground stations or outside data.

This is why—in bombing, reconnaissance, mine-laying and airborne early-warning missions as well as submarine detection—many Navy aircraft are guided by Ryanair doppler systems from Ryan Electronics.

Ryan Electronics is at work in many fields, creating advanced equipment for today's aircraft and preparing for the navigation and guidance of the space vehicles of tomorrow. In Electronics, too—Ryan Builds Better.



### RYAN ELECTRONICS

DIVISION OF RYAN AERONAUTICAL COMPANY • SAN DIEGO, CALIFORNIA

**RYAN BUILDS BETTER**

comes consistent at the dense altitude.

- **Winter weather at Cheyenne generally is severe.** Snow is the rule rather than the exception and strong surface winds normally accompany snowstorms up to a gale drift. During one snow storm in recent years, the ice, which lies on the outskirts of Cheyenne only about two miles from the center of town, was 10 inches thick.

- These winter days are considered severe because Cheyenne lies in an arid zone where snowmelt instrument data since closing last winter. VFR sites chosen for food and supply storage are 1,500 ft. amsl with 1 in. visibility. For helicopters, VFR conditions can be associated with 700 ft. ceilings and one mile visibility.

- Most sites are surrounded by rolling terrain which does not lead itself readily to construction of airstrips, even though only about 4,500 ft. maximum is required. A strip is under construction near Warner and also at the site of the 56th Signals, already open.

- However, the strip site will be restricted to daylight VFR operations since the installation of searchlights, obstruction lights, runway lights, and the provision of new terrain during winter become impractical.

#### Basic Requirements

SAC has established seven basic requirements pertaining aerial transportation between command post and site and from site to site:

- **Combat command.** Commander of the 56th Signals in his 3 x 1 site located directly close to Warner could visit each site once every 10 days if he drove every day of the week. Commander of the 549th, with an area which depended 1 x 9 sites could visit each site once every 10 days if he drove every day of the week. SAC also wants it to be highly desirable that the Director of Wing Operations, a communications maintenance and operations officer, be able to visit the site regularly and frequently.

- **Rotation of personnel.** The rotation of personnel to the 56th site, closest of the 18, on an 8 hr. basis should have been tried and abandoned. SAC particularly is requiring 12 hr. drifts and soon will try 24 hr. and 48 hr. continuous transits. It is quite possible according to Deputy Wing Commander Col. R. D. Stinson, that crews will be at the site for 48 hr. at a stretch. Two crews will be on duty at the site at all times and a crew will rotate each day. Making a round trip by aircraft for a portion of each day will impose loss of a load on the base transportation facilities and will result in much time spending less time in transit. Segments of the 56th and 55th are measured

by 16-man crews plus a powerplant specialist. Rotation of this many people by air does not appear feasible. However, the forward crew of the 549th possibly will be rotated by helicopter.

- **Medical attention.** Advantages of being able to quickly return an ill crew member to the base and replace him with another crewman are obvious. Design and medical considerations are an integral element in the Air Force's plan to meet the long-term needs of bases by nature remote necessity to attend to emergencies of a remote site.

- **Supply resupply.** Possibility of storage or other resupply activity in the vicinity of the sites and along the routes over which missiles, transports and other critical parts may travel can be considerably diminished by providing air transportation ahead of the movement of such parts. Additionally, resupplyments of medical defense forces can be quickly brought into play in the event of a nuclear warhead.

- **Parts within the cargo and weight-carrying capacity of helicopters or light aircraft.** can be delivered to different sites out-of-contract areas. Whenever possible, SAC intends to deliver parts on a regularly scheduled basis, but should an MOCP occur outside out-of-contract areas, it is essential that the parts be delivered as quickly as possible since the goal is



**Electrically Heated Rubber Controls Ice**

B.F.Goodrich laminates rubber units with integral electrical heating elements for bonding in complex curves and odd shapes for bonding in complex curves and odd shapes as well as flat surfaces. These units control ice formation in localized areas such as air intakes, cowls, propeller blades and spars. Elements are thin, can be applied underneath skin or externally.

## B.F.GOODRICH aviation products

Dept. AW-100, Akron, Ohio

# LEWIS WIRE PRODUCTS

**TITAN™ INSULATED HOOKUP WIRE -90°2 to +350°C  
MLW-TITAN™ TYPES E and H**

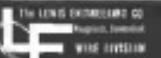
For Missiles, Computers and Electronic Assemblies

Manufacturing and complex electronic assemblies are plagued with the use of Teflon insulated wire. It is insulated by soldering wire temperatures. For a low coefficient of friction, our MLW insulation is the best choice. It is also excellent for resistance to chemicals and solvents. Teflon insulated wire provides superior dielectric strength with maximum low temperature. Manufactured with silver coated copper conductors in 100 volt and 2000 volt ratings. It is .014 in. dia. from 22 awg to 10 awg.

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A qualified product for high temperature applications requiring superior solvent resistance, high insulation resistance and current stability. Silver coated copper conductor, insulated with Teflon and barrier-plastic tape, covered with a Teflonized braid having a Teflon finish. Available in A, M, P, S, 32 core 24 awg, also available in sizes 6, 8, 10, 12 with a type 307 insulation shield braid applied over all.

Superior insulation



Specialists  
In High Temperature  
Wires and Cables



# Nav Aid exam 8 miles high

first assignment for the  
Air Force's new C-140 JetStar

America's ability to be constantly ready for strategic and tactical action throughout the free world is linked directly with the accuracy and reliability of our military navigational aids and air traffic control facilities. Now the Air Force has a high-flying electronic lab that can evaluate these aids realistically under operational jet flight conditions. Name of the plane—C-140 JetStar, made by Lockheed/McDonnell.

Five of the new C-140's will go into service soon with the Airways and Air Communications Service arm of MATS. This important assignment is the first operational military role for the JetStar, which was developed by

Lockheed to meet the Air Force's need for a multi-mission jet aircraft.

The JetStar operates safely in the high-altitude military traffic layer. With four Pratt & Whitney J-60 turbines placed well back on the aft fuselage—behind the eardrums of the crew—the C-140 JetStar achieves Mach .8 cruising speeds. But the new C-140 is more than just quick and quiet. It's a stable platform that assures the accuracy of the sensitive electronic evaluating equipment. And the entire airframe is pressurized and air-conditioned to provide a comfortable working environment for both crew and equipment.

# LOCKHEED

GEORGIA DIVISION • MARIETTA, GEORGIA





# Shifting Aims Delay First T.188 Flight

By Cecil Brownlow

London—Shift in direction of British aircraft development goals is delaying the first flight of the Avro Research Ltd.'s T.188 aircraft research aircraft, due approximately in March—but early autumn is deemed most likely progression of something more specific.

Spokesmen associated with the project and the British government's decision to focus on goals for high speed military aircraft performance plus plans to extend initial supersonic transport designs to a Mach 2.5 regime have caused to revise the date for first flight of the T.188, which it eventually scheduled to push beyond Mach 3. At one spokesman said, "now there's just no hurry for the thing."

The T.188, then due apparently six years ago as a refit of the plane was for future military designs, will be used primarily as a performance vehicle to extend flight characteristics at high speed regimes. Present research missions include experiments with ramjet engine and ramjet configurations plus studies of shock heating, structural stresses and high-speed shock wave formation.

One T.188 aircraft has been delivered to the Royal Aircraft Establishment at Farnborough for static tests. Test flights will be conducted from the Aeroplane and Armament Experimental Establishment at Boscombe Down with GKN Asa, Britain's new chief test pilot, at the controls.

Initial trials of the T.188, powered by two de Havilland Gyron Junior DGI 10 engines producing 14,000 lb-thrust each with afterburner, is expected to be between Mach 2.3 and 2.8, range slightly unexplored.

## Will Exceed Mach 3

After the aircraft has passed itself in its initial design speeds, the range is scheduled to be pushed beyond Mach 3 in progressive steps by the addition of ramjet and ramshock propulsive systems (AVW Dec. 21, p. 25).

The decision to leave the powerplants in long wing aircraft rather than fitting them in the fuselage as wing root engines determined by the original Ministry of Supply requirement stipulating that the aircraft be capable of accepting various engine installations in order to broaden its research capabilities.

According to British officials, low cost, choice of stainless steel for the aircraft, which will exceed Mach 3 flight, was a fortunate coincidence made initially with little thought of such speeds.



**All-TIME** fuselage and wing sections of British Type T.188 (top) were completed at British's Filton works. Webcam gives indication of engine nacelle diameter. First T.188 is scheduled to begin its test flight program in early next year. Model (below) shows proposed configuration of updated Type 188 high-speed research aircraft under development for British government. Includes long, thin wings, nacelles designed to take a variety of propulsive systems. Propulsion system is T7-6, with a span of 35 ft. It is powered by two de Havilland Gyron DGI 10 turbines. T.188 will have a stated maximum speed of between Mach 2.5 and 2.8. However, with more powerful engines, probably including ramjets, the aircraft may be pushed beyond Mach 3.



The Ministry of Supply requirement demanded that the aircraft be capable of sustained speeds in excess of 1,500 mph. British knowledge of literature after the time was that, and also that the aircraft was developed upon as the only

initial capable of coping with the transonic region.

T.188's thin wing, which has a span of 35 ft. 1 in. and an area of 396 sq. ft., has a cambered chord between the leading and trailing edges of 10 inches.

Outboard of the nacelles, however, the leading edge is swept back at an angle of 35 deg., and the tip of the wing, located in the balance area of the aircraft forward of its hinge, has a leading edge sweep-back angle of 84 deg.

## Swept-Back Tip

Detachable fairings have an overall length of 71 ft., a maximum width of 3 ft. 4 in. and a maximum height of 4 ft. 11 in. In order to fit the entire aircraft, the fairing is mounted on top of a integral hook, for

Another Ministry of Supply requirement stipulated that the aircraft should have a conventional aircraft landing gear as opposed to the skid designs of most high-speed U.S. research aircraft.

The landing gear is being constructed by British Metalcast, the firm which won bid without submissions of over £600, by Goodwin, Tye & Rubber Co. Ltd.

Investigations to determine required aircraft behavior and flight conditions will be focused in the landing gear subassembly will be recorded and

used in the analysis for examination after landing, and some will be retained to the ground during flight.

Be weight more than 90% of the material used in the construction of the T.188 were delivered by Firth-Victoria Standard Steel Ltd., of Sheffield. Joint research efforts by Firth-Victoria and Bristol also led to the development of four new steels for aircraft applications. An Italian has spent much time developing however, since his late 1950s incorporation are the T.188.

Stainless steel plates for the aircraft's skin were supplied as relatively large sections in order to avoid an excessive number of joints. Railed bars were used for bolts, fasteners and other fittings.

Special forgings, helmed by Firth-Victoria to be the largest steel forgings for aircraft ever made, were developed for the engine nacelle. High tensile forgings were used for the wing struts and main landing gear strut.

Kevlar fabric of the aircraft is formed a single, 27-ft-long steel logging staircase steel plug also is used on the T.188 for the hydraulic system, which powers the landing gear, flap and one track.

Analysis of the aircraft's vibration levels in the stiffness of each system of springs and to the initial deflections of each system in the datum position, the stiffness of the overall system obtained by differentiating the equation for displacement, has a minimum value of zero defined amount at the datum position, and a high stiffness against large displacement.

Current arrangements for the sprung mass can be varied to provide for a number of cases where isolation from fixed vibration only is required and where sufficient rotational motion is high. These requirements are typical of ground support equipment in missiles and aircraft.

## Undercarriage Ejection Seats

High speed air flow at ejection speed up to 515 ft. per second for the first two sides seats in a configuration with a face subject, have shown that existing seat body restraints are inadequate. Measurements made by RAF qualified researchers at the Admiralty Research Establishment, Farnborough, have revealed load factors of 515 ft. per second in lift and lateral forces the thigh and a 770 ft. per second operating on the seat. These forces considerably exceed normal values.

Tests carried out by the doctor on himself during high speed runs have also clarified the ejection mechanism experienced. Eye widening is not, as previously believed, caused by deployment of the eyeballs in their sockets but is simply due to differential blood pressure effects. Mean pressure of 71 psi acting on the larger area of the chest causes the heart to pump blood into the head which forces the patient and perhaps the weaker blood vessels.

The maximum endurance speed achieved in the Admiralty researcher starting seat at Farnborough was 26 ft. per second, equivalent to a speed of 515 ft. per second. Total body pressure experienced at this speed was 710 lb.

Confirmation on the endurance and exact extensive body loading on the duration ejectioning in this program.

The RAF Institute of Aviation Medicine is conducting a number of investigations into ejection seat applications.

Claired high speed, high altitude research at the Farnborough establishment includes work on a three-seat, side-

## RAF's Sprung Seat Platform System May Isolate Pilots From Vibration

Investigations at the Royal Air Force Institute of Aviation Medicine of the effects of vibration on pilots have led to the development of a simple and compact seat system designed to reduce vibration levels experienced during flight. The sprung seat platform, which was developed at the Royal Aerospace Establishment, Farnborough, is thought to be the first sprung seat that provides a stable point of reference for a supported seat at a particular distance position at all its rigid body degrees of freedom simultaneously.

No aspiration of the system depends on the fact that if the cushion supports a considerably in excess of the natural frequency, the amplitude of the displacement is greatly attenuated. Relative motion of the cushion in these seats is not simply due to differential blood pressure effects. Mean pressure of 71 psi acting on the larger area of the chest causes the heart to pump blood into the head which forces the patient and perhaps the weaker blood vessels.

Proportionate investigations on durability by RAF medical scientists on themselves in a specially constructed static rig showed that a band of low level oscillation frequency, characteristic of different parts of the body, which develop large relative displacements in spite of the body's high inherent damping characteristics. An example occurs at about 1 ft. per cycle period when the body displacement is highly attenuated but the shoulder rotates with an amplitude of the order of two inches. At slightly higher frequencies

the head develops maximum amplitudes. The hips remain at slightly lower frequencies.

If the low frequency, high amplitude, relative displacement, which is called eye rolling, during low level, high speed flight, due to air resistance, the same kind of excitation frequencies forms a significant part of the vibration spectrum affecting muscle innervation.

## System Fundamentals

Principle of the system depend on the fact that if the cushion supports a considerably in excess of the natural frequency, the amplitude of the displacement is greatly attenuated. Reducing the stiffness of a sprung system, the natural frequency of the cushion, the natural frequency between arm and back, determines the system from external excitations.

Absolute seat stiffness cannot be utilized in practical application because it implies that is the event of no displacement there is no restraining force. This condition can be bypassed for most applications by providing a nonlinear stiffness characteristic that provides a non-zero stiffness for small displacements with a rapidly increasing stiffness as the displacement increases. Providing the range of low stiffness es-

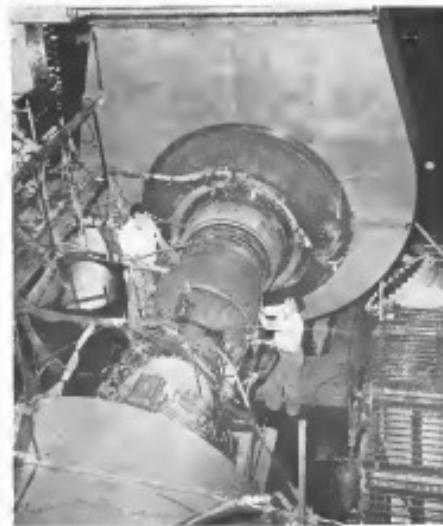
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J57 Tested as Stationary Power Unit

Stationary power unit, using Pratt & Whitney J57 turbojet engine, is tested for a test run at PRW's Wigford test facility at East Hartford, Conn. Engine supplies power to a system developed by Unispace-Bendix Corp., Mt. Vernon, Ohio, and will burn natural gas as it passes first through combustion tube of Colorado Fuel Transmission Co.

In fact, often assignment for an unspecified aircraft, which could have space value potential. The same method may be used in the design of the cargo bay of the Space Shuttle.

Crash investigation believed to exceed very high altitude effects, among the most recent ones, the Vietnam bombers, are also being conducted.

The Institute has devised a number of techniques to simulate an orbital zero g condition. Experiments have been carried out with the subject seated, mainly in an upright, head-down position in the weightless conditions. The principal technique developed differs from that used for similar experiments in the U.S. as offered by Bell Aviation Works, in that the subject does not view a target object directly but through an optically projected image of the same size. The "open" the human control loop and prevents the subject from experiencing the movement of the hand toward the target.

A novel method of determining peripheral vascular resistance in the nephritis condition has also been developed, in which the subject was placed in the Fairbairn carriage, aligned longitudinally with the contralateral armature, feet with his head oriented in a series of positions from 90 to 45° to the left with his head upward for a number of negative g loadings.

The effect of zero g which cannot be simulated in the earth's gravity field is extrapolation to be roughly a straight line passing through the positive and negative values.

A new method is also claimed by medical scientists at Fairbairn to measure cardiac output changes under positive g loading on the centrifuge. Access to the heart was gained by a catheter inserted through a vein in the arm and passing into the right ventricle. Cardiac output was derived from the change in oxygen content of the blood sampled from the catheter.



## PEA IN A POD IN SPACE

is the Bendix Free Reaction Sphere for precision attitude control of satellites and space vehicles. It is an example of technique leadership and career opportunities in advanced systems such as the Eagle missile, Advent satellite communications, and Skyscraper infrared system.

BENDIX SYSTEMS DIVISION  
ANN ARBOR, MICHIGAN



# BELL CLAIMS 7 NEW WORLD RECORDS

Here are the Records Claimed for Faster  
Climb and Air Speed by Bell-Bell  
Army HU-1 "IROQUOIS"

## THE SEVEN NEW RECORDS\*

- 1 Climb to 3,000 meters (3,043 feet);  
Current record: 9:30.6 minutes—held by French Alouette  
HU-1 record claim: 3:22.4 minutes
- 2 Climb to 4,000 meters (13,124 feet);  
Current record: 17:0.1 minutes—held by French Alouette  
HU-1 record claim: 6:18.2 minutes
- 3 Hover Distance, Closed Circuit;  
Current record: 351.1 miles—held by Russia Mil-L  
HU-1 record claim: 401.24 miles
- 4 Speed Run, 2 Kilometers (1.24 miles);  
Current record: none  
HU-1 record claim: 198.85 mph
- 5 Speed Run, 100 Kilometers (62.14 miles);  
Current record: 120.5 mph—held by Russia Mil-L  
HU-1 record claim: 142.2 mph
- 6 Speed Run, 100 Kilometers (62.14 miles);  
Current record: 156.02 mph—held by Sikorsky  
HU-1 record claim: 148.45 mph
- 7 Speed Run, 600 Kilometers (37.24 miles);  
Current record: 102.0 mph—held by Russia Mil-L  
HU-1 record claim: 119.45 mph

\*Tests were run during eight grueling days in July, 1968 under the supervision of the National Aero  
matial Association. Certification is pending from  
M.A. and Federation Aeronautique Internationale.

## BELL WORLD STANDARD HELICOPTERS

Many of these performance advantages are passed on to you in Bell's Model 204B, a commercial version of the HU-1. However, speed and climb records are not all the story of Bell's 204B. It has a payload of nearly two tons and is lower in initial cost, easier to service and cheaper to maintain and operate than any other helicopter in its class. That is claiming new records. Bell also maintains its existing new record established years ago and still unbroken today.

Write for full information on the new Bell 204B—a helicopter designed to fit your toughest needs in the shortest time—at the lowest cost.

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**BELL HELICOPTER COMPANY**  
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## FINANCIAL

### BOAC Deficit Rises; BEA Reports Profit

British Overseas Airways Corp. reported improved operating results in its 1970 fiscal year, but an overall net loss confirmed a trend that has increased its accumulated deficit from \$5.5 million to \$10.6 million in three years.

This is in contrast to British European Airways, which reported a \$5.3 million profit in the same fiscal year and the Canadianairways carrier, Qantas, which reported a \$2.4 million profit for the year 1970 and Trans-Canada Air Lines, a \$192,334 net loss.

Competition with the Commonwealth carriers, or with U.S. international markets, are hard to dose because of differences in accounting practices and terminology and because of the nebulous function of British Overseas Airways Corp. as an instrument of national policy, either economic or diplomatic.

#### Problem Areas

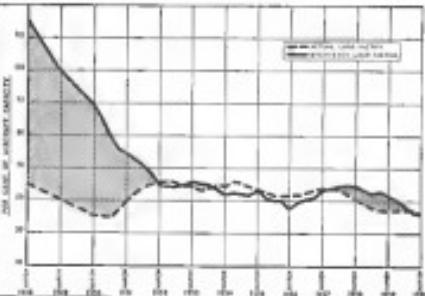
But some insight can be gained into the special problem areas of BOAC by comparing its financials of its 1970-68 profit and loss statement with BEA's:

BOAC	BEA
Operating Profit	1,884,812
\$12,914,664	
Interest on government-owned shares or analogous grants	55,896,514
\$12,323,169	
Interest capitalized	—
\$12,323,169	
Interest receivable	—
\$2,515,148	1,517,997
Schedule comparative profit or loss and related adjustments	267,099
\$3,784,346	
Profit (deficit) for year	37,241,818

BEA shows adjustments, and appropriating \$1.4 million to an insurance reserve and \$1.6 million to a development reserve, yet fails to carry a net balance of \$125,992 in its net. Also favorable adjustments from prior years, BOAC carried a \$1,018,823 net loss to its accumulated deficit, to total \$47,651,993.

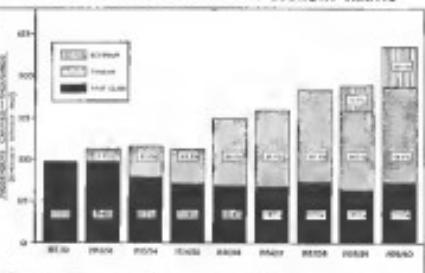
The reason why BEA can lay aside funds for reserves and show a small net profit while BOAC continues to蒙受 deficits appear to lie this comparison in the heavy debt structure of BOAC and its losses on subsidiary and associated company operations.

BOAC subsidiaries meet the parent company's profit for their losses.



BRITISH OVERSEAS AIRWAYS charts show (top) total air travel and business load for the year 1970 and change in share of traffic (below).

#### RELATIVE GROWTH OF TOURIST AND ECONOMY TRAFFIC



Middle East Airlines, for example, carries 51.2 million with feeder traffic worth \$4.2 million annually and posts net it has bought \$15 million worth of British assets and has \$17 million in Canadian assets.

BOAC's total borrowing is almost three times those of BEA. They break down into:

\* BOAC stock amounting to \$160 million and carrying interest rates of 3% to 4%. BEA's comparable stock amounts to \$44 million at 3 and 4% interest.

# CONTROL TOWER IN A SPECIAL DELIVERY PACKAGE



Portable air traffic control towers—to be produced by Hamilton Standard—can be flown or trucked to speed mobilization of remote TAC air fields

The Air Force has selected Hamilton Standard to produce 180 air traffic control vans, plus 83 trailer-mounted electronic shops for servicing the control vans and other types of electronic equipment in the field. The van will be used, as shown here, by the Tactical Air Command to direct air traffic at remote or temporary landing fields.

**LIGHTWEIGHT, RUGGED, EASY-TO-OPERATE**—Each van weighs about a ton, measures 17' x 8', yet houses an operator, transmitters, receivers, and most of the basic weather equipment of large airport control towers. The units are built to withstand the most trying environmental conditions—wind, dust, ice, humidity, altitude. Every construction detail—equipment, lighting, sound conditioning—is engineered to blend man and equipment into an efficient operating unit.

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## HAMILTON STANDARD DIVISION OF UNITED AIRCRAFT CORPORATION

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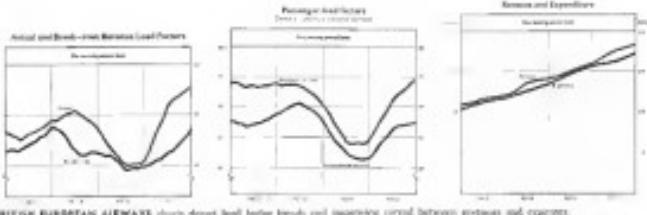
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*Midvac Steels*



BRITISH EUROPEAN AIRWAYS chart shows degree of load factor loads and increasing trend between revenues and expenses.

marked with a load factor of 5.5% and progress presents no aircraft order cancellation at \$40 million nor the major source of the placidity of BEA's capital.

### Fleet Costs

BOAC's statement of capital employed includes \$176 million load factor cost for its fleet of 62 aircraft, \$65 million for program purchases and \$14 million in increments in associated and subsidiary companies at year end 1966. During their 1964-65 previous fiscal year for the number of aircraft:

- \* BOAC average aircraft cost \$400 at \$5.5 million for its fleet of predominantly large, longer range aircraft—British Britannia 102 and 312, de Havilland Comets 4s and Douglas DC-7s.

- \* BOAC average aircraft cost of \$87.000 in its predominantly Vickers Viscount fleet.

Thus the total aircraft component of fleet costs was BOAC costs of \$14 million in Comets and Britannias development costs in 1964-65 fiscal year against the capital amounts, indicating the figure is not reflected in its balance sheet book value, figure for its total fleet cost.

BOAC had just begun to take delivery of its 15 Boeing 707-120s which will add at least \$70 million to BOAC's fleet value this year and that cost is not reflected in the accounts. BOAC also has 15 Vickers VC-10s on order under contracts totaling \$150 million due for delivery starting in 1967.

### New Aircraft

BOAC also has large commitments for new aircraft. BOAC is buying 28 British Aerospace Comets, DHC-31s and 547 aircraft for 20 Vickers Vanguard, due to arrive later this year. This is a costly due to engine modifications.

Assuming powers of both opponents were used this year, BOAC's line is to \$360 million and BOAC's to \$584 million. BOAC, which paid up to a total charge of \$25 million has ten

comparatively \$5 million for BEA, with a substantial accumulated deficit and with a fleet proportionately less than presented than BEA had taken a significantly different tack than BEA had taken in the use of its constituency on the aircraft figures.

BEA argued faultily, apologetic at its low profit and referenced its assets as an asset management as a rational argument to be made, but this part to the point of having merit.

BOAC on the other hand had fully about small efficiencies and took care to point out that in the eight years since its formation period it has had to pay fixed interest charges of \$40.4 million to the government. To do

so, it had to borrow an additional \$10.3 million from the state, which on it has had to pay still further interest charges.

Because of the delay in delivery of the 707s from manufacturers to the air, BOAC said it had to borrow and \$11 million during the year. But additional amounts could be added, say \$20.5 million in the next five years based on additional 5% interest at 1963-64 which is 15% above base. Furthermore such interests should affect morale in total debt but in plan that BOAC will be approaching its statutory loans through it finds the new ceiling will be adequate for all needs.

BOAC did note that it can get rid

## PROBLEMATICAL RECREATIONS 35



Each face of a regular dodecahedron is painted with a different color. Using the same 12 colors, how many dodecahedrons with different color arrangements are possible?

To the National Electronics Conference in Chicago, and to the disorganized operators, we wish a colorful greeting.

LAST WEEK'S PROBLEM: The mother was 6 when her child was born, which makes the infant 55 inches long 12 years later.

**LITTON INDUSTRIES**  
Beverly Hills, California

that the Select Committee on National Defense Industries pointed out that two out of the cost of developing new British aircraft appeared to fall on BOAC and BEA, placing them at a disadvantage with comparison among American carriers. Various measures to provide additional support to the two airlines at the time these will be profit deferred if the manufacturers are so inclined to reduce the price charged for their aircraft. In view of the government, BOAC added, a committee exists.

A specific concern expressed by BOAC was over the costs of its 10 DC-7Cs ordered as an interim measure until its long range Reference 311s became available, on agreement that they would then be incorporated. These aircraft are carried at a book value of \$16.5 million in \$1.8 million per aircraft.

Sale of these aircraft on the open market now might be a suicidal one. BOAC said and no provision has been made in the accounts to absorb such a loss. Stone, or all, of the loss might be avoided if BOAC was permitted to continue to use the aircraft especially on long range charter services.

BOAC's position tends to follow a long-term policy of decommissioning older, less-revenue-producing aircraft rather than continuing to operate them. An analysis of aircraft owned by a U.S. carrier showed most 347As were found to have a 10 year 16% residual value schedule for jet aircraft. BOAC quoted in terms of a seven-year, 25% residual value schedule. Yet a \$4.5 million aircraft that would show a higher annual depreciation charge has a smaller final charge at the end of the depreciation period.

#### Comer Write-Off

Actual practice over very soon from these predictions, however. BEA for example, is depreciating its five Concorde 40 aircraft at the rate of 10% per year, but none of these aircraft has yet reached the point where it could be written down to zero residual value.

In a separate memorandum of its basic competitive objectives, BOAC said that it is pursuing an expansionist policy that has increased its capacity to reflect from 201,694 SEK in 1959-60 with a corresponding average load factor of 74.3 to 455,187 SEK in 1979-80 with an average load factor of 75.6. The risk of this policy to the profit and loss account must be justified by the long term perspective BOAC had.

One area BOAC is stressing is carrying out this objective in the solution of maintenance costs as a contribution to cutting costs even load factors which stood at 75.5% in 1979-80, compared with 75.5% three years previously. BOAC reduced its maintenance personnel by 1,341 during the year, cutting its maintenance department costs £6 million a

quarter ton mile, the report said. BOAC's total passenger rate slightly, however.

BOAC's maintenance costs are 24% of its 1979-80 expenses totaling 5754 million, or 23% of its \$176 million re-

venues. BEA spent on maintenance 35% of its 1979-80 expenses of 591 million or 16% of its income of \$102 million. Though accounting methods may not permit a valid comparison, Pan American spent 15% of its 1978

## Fiscal 1960 Defense Funds

Annotated procurement and armament obligations and expenditures details for Fiscal 1960 have been issued by Department of Defense. Obligations are indicative of new initiating expenditures, of the actual level of production or research effort sustained throughout the year. Comparisons with previous fiscal years are included because of changes in budget categories— notably the shift of funds previously listed under "procurement" to the development, test, and evaluation category.

### Procurement

Agency	Obligations (Thousands of Dollars)		Expenditures (Thousands of Dollars)	
	Unobligated Balances	Spent		Obligated Balances
		FFY 1949	June 30, 1959	
Air Force				
Airwall	327,793		187,000	\$91,923
Materiel	648,126	116,415	267,722	871,073
Materiel and Communications	930,197		194,618	871,140
Navy				
Aviation	1,019,784	1,335,799	1,786,329	\$1,178,834
Materiel	805,268	186,347	240,215	847,299
Materiel and Communications	810,914		179,385	822,510
Army				
Aviation	1,194,463	1,475,309	4,770,830	\$1,201,782
Materiel	2,497,372	487,491	3,758,419	2,184,474
Materiel and Communications	716,411	121,116	767,232	877,287
Department of Defense Total				
Air Force	3,497,363	2,846,026	8,710,310	\$2,872,546
Materiel	3,293,454	787,297	3,816,364	3,801,952
Materiel and Communications	5,218,937	856,216	1,352,201	3,435,357

### Research, Development, Test and Evaluation

Agency	Obligations (Thousands of Dollars)		Expenditures (Thousands of Dollars)	
	Unobligated Balances	Developed Balances		Unspent Obligations
		FFY 1949	June 30, 1959	FFY 1949
Air Force				
Military Balances	164,982	91,939	182,370	\$1,943
Airwall	21,022	18,423	18,339	34,499
Materiel	409,169	42,944	173,916	281,184
Navy				
Military Balances	101,130	2,042	182,560	\$1,174
Airwall	87,508	15,319	93,116	71,188
Materiel	460,799	15,476	204,228	241,874
Army				
Materiel	—	5,300	10,111	1,300
Military Balances	343,132	25,140	197,319	\$87,756
Airwall	373,340	34,878	166,732	327,638
Materiel	726,184	12,034	184,409	381,259
Communications	961,397	9,171	179,348	321,261
Office Secretary of Defense				
Military Balances	54,400	7,566	31,466	\$4,621
Materiel	60,730	27,723	25,112	59,499
Communications	981,389	295,145	447,416	—
Department of Defense Total				
Military Balances	902,230	41,381	280,879	\$81,792
Airwall	161,760	26,566	304,113	333,278
Materiel	1,207,323	65,794	702,512	721,747
Communications	481,739	41,584	453,113	395,897

total expenses of \$339 million on route to route and TCA 20% of its \$120 million 1959-60 total expenses.

Under its heavy defense charges, BOAC has one other major area of conflict with BEA in its schedules and associated company operations. The results in 1959-60:

- BOAC share of losses for subsidiary companies British West Indian Airways, \$1,718,000; Hong Kong Airlines, representing second loss on sale of the company during the year to Cathay Pacific Airways, \$375,000; Midwest Airlines Co., \$107,000.

- Losses on associated companies Bahamas Airways and Samoa Airways, \$80,000.

- Losses on Kuwait Airways mentioned centrally earlier, \$60,000.

- Profits on subsidiaries Adria Airways, \$165,000; Gulf Aviation Co., \$65,000.

- Profits share of associated companies Anti Airways, Im Agadirian, Green Airways, Maldives Airways and Middle East Airlines, \$18,000. (The \$18,000 net profit of Middle East Airlines was a notable improvement over the prior year when it earned lost \$4.5 million.)

- After adjustments are desired for the use of subsidiary operations reported by BEA, BOAC totals \$1.1 million.

BEA does not appear as an item in its schedules and associated companies' loss it reported except of \$220 million. This is because its 1959-60 total earnings information including Air Transport, Ltd., which operates services in London, Air Lines of Ireland, Aer Lingus of Dublin, Cyprus Airways and Malta Airways.

### Caravelle Paces French Exports

Pain-Signed up delivery of 500 Caravelles by its transport division the first half of 1960 have fuelled the industry's research export figures to \$161 million more than twice the export value delivered in the previous year.

French industry, in fact, claims that its overall export performance, if current figures are related to number of aircraft orders, is higher than either the U.S. or Great Britain.

French aircraft exports, about half of which are accounted for by Caravelle sales, are expected to reach \$300 million by mid-year. Once again, the high export growth will be due to continued Caravelle deliveries.

In addition to the Caravelle, the next largest item on the industry's export list is made up by mirage. Some \$25 million worth of aircraft, mostly Nord Aviation SS-10 and SS-11 anti-aircraft interceptors were delivered during the first half of the year.



CHARLES E. MCNAMEE, VICE CHAIRMAN, MARTIN COMMUNICATIONS DIVISION

• Why did I move to Martin-Orlando? Opportunity for professional growth...doing as big a job as I could handle. More money and better position, too. Any company that's growing as fast as Martin presents many opportunities.

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Frank industry, in fact, claims that its overall export performance, if current figures are related to number of aircraft orders, is higher than either the U.S. or Great Britain. My wife and I really like living in Florida. Never snowbound in winter, no snow suit to put on my little girl every time she goes out. A great place to raise a family. The school system is good too. □

Write G. H. Lang, Director of Employment, The Martin Company, Orlando 7, Florida. THE CLASSIC OPPORTUNITY TYPE SEE FIGURES III AND 131

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RAYBESTOS-PLEXIGLAS GENEVA MFG.

### Okanagan, Bristol Merger Collapses

Vancouver—Proposed \$4 million merger of Okanagan Helicopters, Ltd. and Bristol Aerospace has been canceled and Bristol President R. J. Ross says his company was attributable to "differences of opinion between himself and Bristol's board of directors." D. S. Hugger, research vice president of Bristol, succeeded Ross as president of Bristol.

The deal, which had been expected (AW, Jan. 20 p. 16), would have been completed by early March. It called for Bristol to acquire all outstanding shares of Okanagan at \$4.50 per share and to extend the company to the purchase of Sparco Air Services of Winnipeg and Avistar Helicopters of Montreal. It is understood that Bristol was unable to finance the deal.

### New Offerings

Kofmehl Corp., Northborough, Mass., principal products include carbon monoxide generators and other optical components, lenses, mirrors, and various electro-mechanical equipment and chemical apparatus. Officers say 50,100 shares of common stock, \$5,000 short-term to be offered for public sale for the account of the company, and 45,120 outstanding shares in the present holding thereof. Public offering price and underwriting terms to be applied in accordance. Proceeds from the stock sale, together with the proceeds from the private sale of 27,500 shares as principal amount of long-term notes and general funds available from retained earnings, will be used to reduce all of the company's outstanding debts of 7% cumulative interest plus 10% on unpaid amounts over \$41,750 plus accrued dividends to raise the company's working capital. Mortgage notes to the unpaid principal amount of \$28,500 plus 10% premium and 10% annual interest, the outstanding short-term bank loans, previously aggregated \$680,000, to purchase, improve, restore \$100,000 of real property and equipment for the production of tungsten rod.

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\$1,100,000 will be applied to construction of a plant in Nauvoo, \$100,000 to the purchase of machines, and equipment, the remainder added to the ground funds.

The Hollister Co., Chicago, Ill., engaged in research development and manufacture for the military, the medical, scientific and industrial sectors, electronic components, communication equipment, fixed station communications equipment and airborne radar tracking equipment. Offering is 100,000 shares of capital stock, 100,000 shares for public sale by the owner of the company, and 200,000 outstanding shares for the present holders thereof. Offering price and underwriting terms to be supplied by underwriter. Proceeds of the 100,000 shares will be used to increase the company's working capital \$1,000,000 of which will be used in temporary reduce short-term bank loans. In the new future \$500,000 of the company's funds will be used to purchase no shares and equipment and possibly have facilities for a plant built in Chicago and \$200,000 for expansion of plant, development of new products, administrative facilities and purchase of laboratory equipment for the existing plant.

Vitronics, Inc., Bedford, Conn., engaged in the manufacture and sale of solid state positive electron beam position and intensification monitors/detectors. Offering is 100,012 shares of common stock, 25,000 shares for public sale in the company, and 77,887 outstanding shares. In the present holder thereof the total proceeds of \$1,000,000 will be used to defend and increase production \$113,500 to prepare the factory of mortgage notes for balance for working capital.

Milgo Electronic Corp., Miami, Fla., engaged in the business of designing, developing, manufacturing and selling an integrated line of electronic components and systems for use in various missile and space programs. Offering is 65,000 shares of common stock. To be offered for subscription in batches of outstanding common stock at the ratio of one new share for each one share held. Fixed date subscription price and underwriting terms to be supplied by underwriter. Of the proceeds, \$65,000 will be used to increase working capital, from \$100,000 to the equivalent of the values of work in progress and of inventories, and funded pools \$125,000 for development of certain components for use with presently existing general purpose analog computers, the balance for working capital.

AIRPORT WEEK October 10, 1968



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### BENDIX SYSTEMS DIVISION

ANN ARBOR, MICHIGAN

## WHO'S WHERE

(Continued from page 23)

### Honors and Elections

Dr. C. Stark Draper, head of the Department of Astronautics and Aerospace Engineering and director of the Environmental Test Laboratory at Massachusetts Institute of Technology, has been named a Fellow of the Franklin Institute, and N. Peter Mohr for his "outstanding and significant contributions in the design of control systems, which have resulted in outstanding advances in the accuracy of navigation below and in the surface of the ocean through the use of sonar," was elected a fellow.

E. V. Hines, Wright-Patterson Air Force Base, was president and chairman of the executive committee for her elected president of the National Society Industrial Art. For the evening session,

W. T. McLean, superintendent of Pitsford-Woodlawn Sewage Treatment Plant, Webster, New York, was elected a fellow member of the American Society of Civil Engineers. She has graduated a few years ago of pleasure to serve as Senior Technical Officer (Intelligence Assistant) in the Secretary General of the World Meteorological Organization, Geneva, Switzerland, as well as chief of the Administrative Division of the institution.

### Changes

Col. Charles E. Dugay, defense commander, Pacific Missile Range Headquarters, Ft. Monmouth, Calif.

Dr. Robert E. Molson, associate technical director for aerodynamics, U. S. Naval Ordnance Laboratory, Silver Spring, Md.

Gen. Harry E. Giddings, Jr., acting director, Air Materiel Control Service, Air Materiel Control, Wright-Patterson Air Force Base, Dayton, Ohio.

Harry A. Frazee, chief engineer, satellite department, Bell Aerospace Co., Buffalo, N. Y., a division of Bell Aerospace Corp. Also Neil A. Mentzer, director of aerospace activities, Bell Telephone Lab, Inc., and Paul H. Butler, Jr., director, Defense Communications Center, Washington, D. C., both representatives for Bell Aerospace.

Stanwood J. Korchak, manager of equipment support, General Electric Co.'s Avionics Division, Research & Development Department, El Segundo, Calif.

Mr. Elmer A. McMillan, formerly Mr. Sheldon in West Coast (Los Angeles, Calif.) director manager for GE's avionics power requirements for aircraft, missiles, space vehicles and marine and ground applications.

Douglas C. Manning, marketing manager, Electronics Division, Baja Network Watch Co., Ft. Lauderdale, Fla.

William F. Vogel, chief telecommunications systems research and development, Danvers, Mass., Telstar Corp.

The Dowson, Inc., space division manager, Denver, Colo., formerly Project Manager & Manager, Denver, Colo., a subsidiary of Ling-Temco-Electronics Inc.

William E. DeMoliner, manager, research and analysis, Houston Standard Division of United Aircraft Corp., Wichita, Kansas, and Harry E. Gandy, operations manager, Donald G. Roberts research and development in engineering manager.



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The Denver, Colo., office manager, Mr. Edward J. O'Farrell, and the manager of the Denver, Colo., office, Mr. John F. Murphy, are also available for interviews.

The Denver, Colo., office manager, Mr. Edward J. O'Farrell, and the manager of the Denver, Colo., office, Mr. John F. Murphy, are also available for interviews.

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# BUSINESS FLYING



**EXECUTIVE AIRPORT** being developed by Sphere, Inc., near Ft. Worth, Tex., will have flowing off-terminal building (right) and a main field (left). The new airport will provide larger space and facilities for 240 aircraft.

## Executive Airport Planned for Ft. Worth

By Kevin J. Bullock

Ft. Worth, Tex.—The first step toward construction of an \$8 million executive airport, which is planned for having 240 aircraft, was taken here with signing of a contract between Sphere, Inc. and Texas Steel Building Co. for erection of 20 prefinished buildings.

Completion of the new 650-acre airport designed exclusively for business and private aircraft will begin early in 1961, according to a spokesman for Sphere, Inc., which is developing the project.

Final completion is scheduled for March 1962.

The airport will include a 6,000-ft. runways with 100 ft. shoulders, one 1,700-ft. general aviation runway, a 175-space hotel and control tower. The airport will be located some 5 mi. south of Ft. Worth adjacent to a 25,000-acre industrial development.

### Lease-Purchase

Financing of the project will be a lease-purchase proposition. A venture of New York real estate interests is purchasing the land, building and office facilities and leasing them back to Sphere, Inc. The company, headed by a group of Ft. Worth business leaders and Dallas investors, has turned around a "dead" lot, left from a former oil lease, to build four office buildings, each containing 10,000 sq. ft. Four have been leased for a total of \$1.1 million, so far, while the other three are still available.

Each building will have a clear span of 40 ft. x 17 ft. x 12 ft., the interior at 54 ft. x 17 ft. x 10 ft. The walls will have 10-in. thick masonry from 31½ ft. down, the larger will handle planes in the "Twin Beech and Avco Convair" class. A Texas Steel spokesman said that the \$7 million contract agreed with Sphere is the largest of its kind

signed in a strategic area which is undergoing industrial development, but we've got no representation activities in the state except for two companies. At nearby Meacham Field, for example, a survey shows that plane movements there are expected to reach more than 192,000 in 1970 compared with approximately 135,000 now and that the number of aircraft based there will grow to about 400, more than double the current figure.

Sphere, Inc., also is studying future development of its operation beyond the airport. Indications are that plans include development of a bus and railroad around airports and entering the business aircraft design and production field. The latter is set to occur in the next five years.

### Hanger Facilities

Hanger facilities to be built include bus buildings, each composed of six complete bays, 130 ft. x 127 ft., with a clear opening of 120 ft. and a 30-ft. tall clearance. Shop and office space will separate each hangar to provide individual operating space. Over all length of each building will be 1,800 ft.

In addition, 24 hangars will be erected, one going having a clear opening of 40 ft. x 17 ft. x 12 ft., the interior at 54 ft. x 17 ft. x 10 ft. The walls will have 10-in. thick masonry from 31½ ft. down, the larger will handle planes in the "Twin Beech and Avco Convair" class. A Texas Steel spokesman said that the \$7 million contract agreed with Sphere is the largest of its kind

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- Missile Systems—Largest supplier of auxiliary power units, Affiliates also working with hydraulics, hot gas and hydrogen systems for missiles, liquid and gas cryogenic valves and controls for ground support.
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bred by his company. That is Dr. Worth's show-and-tell deal for Infrared Steel Products Co.

It is expected that the project will be completed in Oct. 31, 1963, with the hardware and initial software to be in by the end of next year. Spacelab Inc. currently is negotiating lease agreements with NASA for the Argos and will lease the model to a national chain operation. Selection of an export manager is the major consideration.

Operations is planned as a 24-hr basis, with complete servicing, sales and storage facilities. General building will include a private club, business center, movie room and restaurant seating 175.

Officers of Spacelab, Inc. include Raymond H. Boyce president; Paxton C. Cray, board chairman and vice president; Ken R. Boyce executive vice president; Stephen J. Holloman, treasurer; Robert J. Hennemann, vice president and D. T. Choi, treasurer.

Architects engaged on the project are Holman, Cleland & Jones, Ft. Worth, Texas. Construction handled through Owner W. Stensel, Georgetown, Tex., and Nathan Wheland, N.Y.C.

## Interior Modified In New Comanche Models

Lock Haven, Pa.—Interior refinements will be the new 1961 models of the four-place Comanche because place on which Paaq Aircraft Corp. is running elections to decide this month.

Important changes over last year's model include revised instrument panel layout, modification of a three-axis autopilot and automatic radio direction finder for broken-in replacement of the hand helds; a standard equipment increased payload and improved cabin heating and ventilation.

The Comanche 230 also is available with a 90-hp fuel capacity, an increase of 50 gal over previous models, providing more than 6 hr at 175 mph maximum cruise speed at 12,000 ft range at 137 mph constant cruise speed. Gross weight for the 230-hp version also is up 300 lb, providing a permissible useful load of 2,270 lb.

New model's instrument panel layout is similar to that used on the light twin Apache. Basic instruments are located on the left side, in front of the pilot engine gauges are reflected to the extreme right; and radio equipment is centered for optimum usage by either front seat occupant. A second console for cabin air flow and temperature also is located on the panel.

Pilot often the heavier instrument panel is standard equipment on the Comanche, but this year is providing an optional equipment; a three-dia-

gital all-transistorized autopilot system, including pitch control, course selector, heading lock, altitude parameter scale and altitude hold. The new equipment costs \$1,245 additional.

Standard on the 1961 Comanche are two hooks on the left side, supplementing the large hooks. Safety valve gas rooms either left or right, system frame being strengthened.

In 1961, Ibis is offered, as well, in four models—Standard, Custom, Super Custom and Antibird. Standard version includes knee instruments and lights. Custom model includes a whizzed geo panel and radio navigation package consisting of a 12-channel Navco Super Inter for VHF communications and area navigation and the Piper Autopilot LF RDS direction finder. Super Cas-

tan replaces the Superinter with a Navco 66, V. 90-channel transceiver (VHF-channel crystal-controlled system) for VHF communications, coupled with Navco VOX 16 area navigation selector. The Antibird version has all of the Super Custom's equipment, plus the Piper Autopilot and autopilot.

## Southwest Airmotive Shows 40% Sales Gain

Dallas, Tex.—Growth of 40% for the fiscal year ended May 31, 1960, the single fiscal period last year is reported by Southwest Airmotive Corp., a major business aircraft service and sales firm. Total sales for the year



**Private Viscount Modified**

Fuselage interior is shown after modifications to The Garrett Corp.'s Affiliated Astronautics Division, Fort Worth, Texas. The four-seat cabin, modified to accommodate 12 passengers and a crew of five is equipped with reclining seat sets with extendable leg rests, sleeping deck, adjustable headrests and sun filtered glass.



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to bring the oil supply to the proper quantity of 16 gal. The aircraft was equipped with VOR, VHF, ILS, LF/MF, and marker beacon receiver and a VHF transponder.

### Analysis

It is impossible to relate this accident directly to the mechanical conditions, including lack of maintenance of the aircraft. The aircraft was suddenly overflight upon departure from Kinston. However, the aircraft was under its maximum gross weight of 2,910 lb. by at least 15% of its maximum takeoff weight. It appears completely, at this point, out of fuel.

The cause of aircraft malfunctioning at the end of the initial cruise is difficult to establish. Approximately the last three hours of an aircraft flight may be filled with many wild and unpredictable engine malfunctions, without lights and order in aircraft. This was not ADP in the aircraft, so it had been removed for separate PGM test duration limited to 1000 ft. The low frequency radio range. Under these circumstances, the aircraft would have had to be down-reduced to be returned to low frequency range. Fuel flow read 21 lb. at fuel stop having taken off for a flight that he estimated would take about 14 hr. However, he became lost and consumed considerable time and fuel before landing at Kinston. The aircraft was then parked on the ramp of McCarthys Food in Kinston, and fuel consumption figures indicated the fuel would have been exhausted at the time of the accident. This seems to corroborate information from Mr. McCarty, the pilot claimed only five minutes to make a forced landing. Should we consider the possibility that "At 1,000 ft. in the early hours of 10 a.m. at Kinston, he had less than 20 sec. on down." This again indicates that he had already run out of fuel.

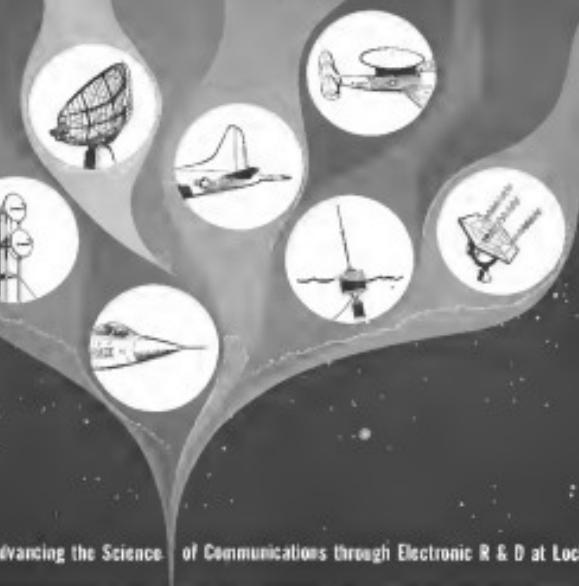
### Not IFR Qualified

John Paulson flew in a very dangerous situation. Although the aircraft had been flying in the dark, he apparently could fly in instrument flight. He obviously was not able to cope with routing requirements. Accord with the Bremerton weather report at 10:45 p.m. had very good low which he could, at his lowest instrument exposure, probably have avoided.

The increased workload and the extreme deterioration continue expert following, a fuel stop speed. The new fuel for which followed the crash also suggests that these air miles or less were in the Bremerton's time.

Researches at all major components of the aircraft were separated from the cockpit, so it is logical to conclude that these were no single failure of the aircraft.

Paulson, from what are the lights of McCarty as he left, but lost them as he descended, and a falling blacked vision. It is possible that he could have lost another light, which would account for McCarty as he saw no evidence of lights between him and McCarty. It is also possible that he could have seen the lights of Tamaha Airport Control and Warning Alarms if it was hidden in a hill. The weather he experienced was substantially favorable and the flight, therefore, should not



## Advancing the Science of Communications through Electronic R & D at Lockheed



The extent of the science of communications is as great as the ultimate itself will allow. From earth, in the stratosphere, to the moon, explored at Lockheed. Our pursuits cover the spectrum of communications problems—on and under the water, tracking missiles and satellites—through components to complete systems. ■ One essential phase in the electronics communications R & D program is the development of antennas and supporting equipment to receive television, tracking and relay data—which is designed to answer a particular need. This program is vital to support our sophisticated aerospace projects—now and in the future. ■ Areas under investigation in electronics and other fields include the creative field: Design and development of data processing equipment, VISTOL design and development, electromagnetic research in ionosphere and breakdown studies, surface wave generation, antenna vehicle interaction, millimeter wave radar, electrical instrumentation, infrared and solid state physics, biophysics research, ion radiation hazards connected with space flight, solid state electronics, underwater sound propagation and oceanography studies, acoustical engineering, dynamics, aeroacoustics, and aerodynamics, as well as a few of them. ■ Scientists and Engineers. The challenges and rewards of our current and future programs are infinite. If you are experienced in any of the areas mentioned above you are invited to investigate opportunities offered by a company that always looks for the future. Write today to Mr. S. W. Des Lassens, Manager Professional Placement Staff, Dept. 1118, 1100 Hollywood Way, Burbank, California.

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SIXTH ANNUAL  
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**Aviation Week**   
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# FPD PROFESSIONAL EMPLOYMENT NEWS

PUBLISHED BY THE FLIGHT PROPULSION DIVISION OF  
GENERAL ELECTRIC IN CINCINNATI, OHIO / OCTOBER, 1960

For more information on openings throughout the industry contact Engineers and Scientists Technical Interests and news relating to current projects will also receive from this or other GE services.

## General Electric Forms New Space Power Operation

A new Space Power Operation has been formed by the Flight Propulsion Division to consolidate interests external to space power and propulsion during the past 14 years. The new organization will be responsible for the design and development of systems for power auxiliary equipment and electrical propulsion systems for advanced space vehicles.

According to FPD General Manager David Cockrell, "Progress in the space power field has developed to the point where it is no longer feasible for one man to fully utilize the technology being created." He noted that the Space Power Operation would expand new projectable technology while space efforts.

### Mission Power Manager by Operation Manager

M. A. Zupan, who previously guided FPD's overall programmatic system activities as Manager of Defense Programs, will head the Space Power Operation. Concentrating on the work of his three groups, Zupan emphasized the high efficiency potential of mission-oriented performance theory.

Requirements already existing are extensive in nuclear, solar, chemical, thermal and high temperature liquid metal as the working fluid.

Other future requirements for space power systems have been defined as an auxiliary power source, power management systems on interplanetary probes, long flight power sources, power for large orbiting stations and a power relay communication system.

#### FLIGHT PROPULSION DIVISION

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Detailed addition to all data on the space power supply. Power systems can be designed to meet the needs of the user. This research should be continued to develop the best possible power system for each application. This is the function of the Space Power Operation.

### Diversified Programs Offer Many Opportunities

Systems of semiconductor components in FPD's Space Power Operation are the result of the R&D effort and the C-10000 all-in-one integrated electronic system now under development. Other opportunities exist in the areas of power conversion and replication, sensors and space programs. Detailed discussion of these opportunities for professional achievement in FPD

Professional openings in Space Power Operations and other expanding areas include Micro Systems / Physical & Analytical Chemistry / Electrical Control Components Design / Engine Controls / Thermal Analysis / Mechanical Engineering / Instrumentation Design / Ion & Plasma Propulsion / Liquid & Solid Rocket Propulsion.

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To cope with this problem, science and technology must provide the Military Commander with the means to exercise his command effectively. It must give him the facilities by which he can evaluate and extend his control over his weapons. Without such support to the Commander and his command organization, effective peacetime deterrence, wartime defense and retaliation are impossible.

Optimization of the command and control function can be facilitated by electronic systems which collect, transmit, process and display the data required for the decision making process. These systems involve, to an unusual degree, interrelationships among technical factors, operational factors and the command structure in which the systems are to function. Further, these system requirements cannot be considered independently of the technical capabilities of men and machines.

The MITRE Corporation is a nonprofit organization formed in 1954 under the sponsorship of the Massachusetts Institute of Technology. It provides technical support to the United States Air Force's Command and Control Development Division. Its nucleus is composed of the engineers and scientists who designed and developed SAGE—the world's largest real-time control system. Its task is to design, develop and evaluate large-scale, computer-based command and control systems. Its technical competence and its objectivity will provide the Military Commander with compatible systems which meet the standards of technical realism.

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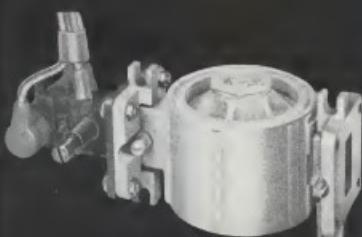


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VA-1299 Stalō Cavity shown with VA-201B Klystron

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Short term frequency stability	As high as 1 part in $10^3$
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Stabilization factor	As high as 120
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Unloaded Q	As high as 110,000
Temperature compensation	As close as one part in $10^4$ per degree Centigrade
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